JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

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EDITORIAL NOTES—GAS, &c.

The Growth of the Gas Industry's Business.

THE gas industry continues to withdraw itself, with substantial strides, from that incipient decay which those who are not among its well-wishers were eagerly looking for not many years since. This disinclination of the industry to comply with the hopes and prognostications of those who are inimical to it, will have been patent to all who have had an opportunity of investigating the particulars that were quoted in last week's "JOURNAL" from the Board of Trade returns relating to the gas undertakings that work under statutory authority. The returns refer in the case of Companies to the year ending December, 1905, and in the case of the Local Authorities to the year ending March 25 last. The figures denote an exceedingly satisfactory progressiveness. Taking the totals, there is only one that shows a setback, and that is the item of receipts. Important as receipts are, the decrease, scattered over 752 undertakings, is comparatively small; and what has been the industry's loss in this single respect has been, in considerable measure, the consumers' gain. And in view of the increased business that has been done, at lower prices than formerly, the gain of the consumers cannot possibly be represented by the concrete figure of difference between the income of the year and that of the previous one. Lower market values for certain residuals also, no doubt, have had a partial effect on the receipts. Anyway, a reduction in the total income of the industry has been a rare occurrence in the past twenty years. There has only been before, in that period, three such happenings in the case of the Companies; and only one in the case of the gas-supplying Local Authorities. The last time a decline in aggregate receipts occurred followed upon the general reductions in price when the financial position was being recovered after the great upward flight of the coal market in 1900-1. On the present occasion, it is the Companies alone who have shown a loss in receipts; the Local Authorities having improved their position. An explanation would be interesting. The total income of both classes of undertakings was £27,253,705; being a diminution of £121,849. The Companies, however, had a reduction of £211,274; but the Local Authorities an increase of £89,425. That the decline is not due to any recession in the Companies' business is adequately witnessed by the fact that their advance in gas consumption during the year is represented by the healthy stretch of figures, 3,593,290,000 cubic feet, which compares with 2,234,710,000 cubic feet of the Local Authorities. These figures are not put into juxtaposition for the purpose of showing superiority; but for the sole object of indicating that lessened income has not been produced by a lessened business in gas.

All the remaining total statistics also declare that the vitality of the gas business has been in nowise impaired; and, taken as a whole, growth is luxuriant, and quite in accordance with desire. There are nineteen additional concerns, all relatively small, which are included in the returns by transfer to local authorities from private ownership, or through being just endowed with statutory powers. But the incorporation of these does not make any great impression—as greatness is measured by such totals as those we are dealing with—on the increases. However, the capital invested in the gas-supply and bye-products businesses at the dates to which the returns are made (£124,184,221), shows an increase of close upon £3,000,000. The industry's revenue has just been dealt with; and as to the working expenditure of £20,496,017, there is an increase of £45,816—due to the larger business done, and such additional calls on the undertakings as are imposed by higher rates. The bulk of coal carbonized was raised to 14,480,325 tons by an addition of 184,723 tons. The quantity of gas made (including water gas) was 174,904,791,000 cubic feet, or an increase of no less than 6,257,115,000 cubic feet; and the quantity sold was 161,407,725,000 cubic feet, or an advance of 5,828,000,000 cubic feet. These figures illustrate abounding prosperity; and yet they do not exhaust the illustration. But sticklers for accuracy will be curious to know how much of the augmentation of business revealed by the returns is accounted for by the fresh introductions. The extension of the figures that they have produced is over-represented by 450 million cubic feet; so that the real increase in business was approximately 5400 million cubic feet. Regarding water gas, the increased output was not one-fifth of the additional consumption of gas—the total make of water gas being 19,736,859,000 cubic feet, or an increase of 984,359,000 cubic feet. The business in acetylene gas in the Banffshire town of Portsoy appears to be standing still, if not slightly diminishing, seeing that the consumption in the period covered by the returns was 101,250 cubic feet, as against an estimated consumption the preceding year of 103,500 cubic feet; the respective quantities of carbide of calcium used being 11¼ and 11½ tons.

There is a vast amount of interest to be extracted from the returns by anyone having a fancy for statistical investigation. For instance, it is found that, taking the past ten years, the average annual increase in consumption (including the new undertakings) is 4,996,402,300 cubic feet; so that the increment for the past year of 5,828,000,000 cubic feet is well above the average. Incidentally, it may be noted that the increased consumption during the ten years has been 49,964,023,000 cubic feet. The improvement made in the carbonizing returns is also disclosed by taking the comparative figures at the beginning and the end of the decennial period. The total quantity of coal carbonized in the twelve months covered by the present returns was (as previously stated) 14,480,325 tons; while ten years ago it was 11,937,446 tons—being an increase of 2,542,879 tons. Dividing the output of gas in these returns (155,167,932,000 feet, after deducting water gas and acetylene gas) by the coal used, we have an average make per ton of 10,715 cubic feet; and dealing the same with the output of ten years ago, the production per ton was then 10,171 cubic feet. This is distributing credit broadcast for improvement in working; but it is common knowledge that many undertakings have not enriched their carbonizing records, while others have mounted up to far superior figures than the 10,715 cubic feet shown here. At any rate, to have got so near to an average production of 11,000 cubic feet per ton, is a good index to the progress in the adoption of improved carbonizing plant and method.

Reverting to the comparisons with the year preceding the present returns, it is seen that the consumers (numbering 5,064,075) increased by 326,898. Now looking back again ten years, it is found that the augmentation has been in the decade 2,404,304. The consumers supplied per mile of main has also bounded up from 111·4 to 163·3, notwithstanding that the increase in the mileage of main in the interim has been 7074. The number of public lamps supplied was, up to the dates of the last returns, 665,791—an increase in one year of 11,608.

One among many other interesting points concerns recent small purchases of undertakings by local authorities. It is seen that in the year covered by the returns Chard incurred, after meeting interest and sinking fund, a loss of £612; Rickmansworth a deficit of £658; while Omagh paid their interest, but set nothing aside for sinking fund, and then only had a balance of £27. It is vain, in some districts, for local authorities to strive to emulate those local authorities, with populous areas, who purchased their gas undertakings before the great spurt in business produced by the prepayment system, cooking and heating stoves, and the extension of the use of gas for industrial purposes.

This last paragraph can pass without further comment; the deficits themselves tell their tale. Omitting it, therefore, from consideration, the several calculations that precede

show, with the emphasis of largeness, the industry's unflagging progress; they indicate more and more the expansion of service and appreciation; and several of them are significant of the consideration shown to consumers. The gas industry, excepting in a few sluggish quarters, knows its own business. It may also be submitted to those holding the doctrine that civic management is the best that, if private gas enterprise exhibited the supineness to public requirement that is so often advanced, it would not make the substantial progress that is presented in these returns, but, on the contrary, would assuredly reap the reward of well-deserved retrogression.

Commercial Gas Company's Accounts.

The financial result and business accretion of the past half year's working will both be pleasing to the proprietors of the Commercial Gas Company. The Company have again shown great animation in their prepayment meter and stove departments. Looking at the accounts for the corresponding half of 1905, it is found that they have only missed by 256 attaining the good round figure of 10,000 new prepayment connections in the year—the total now being 54,968. The rental (not including gas) derived from this source in the half year was £12,042, or an increase of £2127. Stove connections also, by an addition of 6782, have risen to 45,119; and the rental from this source also shows an improvement of £1133—the total being £7202. The ordinary meters number 24,257; and the rental from them amounts to £2878. From these figures, it will be gathered that the prepayment and stove branches have produced a tremendous influence on the business of the Company during more recent times. The consumption of gas for public lights and under contract and for private lights has increased by 55¼ million cubic feet; and the gas receipts for the past half year are £189,898, or an increase of £5270. Considering the character of the half year in heat and light, this gain is excellent; and it is fairly certain that prepayment and day consumption accounts for it. Ratepayers in the Company's district have evidently been obtaining advantage in connection with the public lighting, seeing that the receipts from public lamps (£5946) are £935 less than twelve months since, while the number of lamps have only diminished by 18. Regarding residuals, coke and breeze show gains; but tar and ammoniacal liquor are not quite so good by a few hundreds. However, the total revenue was £260,789; being an increase of £9416. As might be expected, coal and oil are responsible for an increase of £8629—the total cost having been £91,519; but the variations in the other items under the head of manufacture cancelled the increase, with the exception of £942. But, in connection with the increased cost, it is noticed that the Company carbonized 1757 tons of coal less; but they have, judging by the information afforded (including the fact that an additional 21,432 gallons of oil were used), been making rather more use of their carburetted water-gas plant. But considering the smaller quantity of coal carbonized, the increase in the consumption of oil and the other statistical information presented, are not sufficient to account for the extra 56,737,000 cubic feet of gas that was produced; so that, at the meeting, the Chairman will probably have something to say about improved carbonizing returns. The only other item that specially attracts attention in the revenue account is the item of rates and taxes, which, standing at £13,184, is up by £2569. In the result, the total expenditure is £196,263, or an increase of £5920. The balance carried to net revenue account is £64,526, and this is an improvement of £3496. The same dividends of £5 4s. and 5 per cent. are recommended. The Chairman, at the meeting on Thursday, will not, so far as can be seen, have anything startling to tell the proprietors; but he will have no difficulty from the figures in proving to them that they are in possession of a comfortable and growing business, though serving to large extent a working-class constituency.

Industry and Municipal Socialism.

In the turmoil of the County Council election campaign in London the thoughts cannot be restrained from consideration of the important influence the result of the election will have upon the welfare of private enterprise—not private enterprise as represented alone by individual and joint-stock industry within the Administrative County of London, but private enterprise as so represented throughout the length and breadth of the country. During the *régime* of the Progressive-Socialist majority in the County Council, the Spring Gardens Council Chamber has been the birthplace of many wild schemes; it has been the source from which a debt out of all proportion to the growth or the requirements of the population of London has mounted up, and it has produced for the ratepayers of London an embarrassing financial responsibility. London has dismissed a considerable part of the Progressive-Socialist combination from the business of the Borough Councils; and very serious work is now being done to further stop their spendthrift course, by relieving them of power in the County Council. But should, unfortunately, the issue be the disastrous one for London of the continuation in authority of the Progressive party with its socialistic propelling power, that issue would, we say deliberately, also gravely affect industry throughout the country. Stimulated and encouraged by the success in London, the Socialists, Collectivists, or by what other name men of the same stamp chose to be known, would fiery-footed revive with strong force the war against private enterprise, and urge for its earliest possible sacking.

In the Metropolis just at the present time, no word is sufficiently hard or bitter to apply to private enterprise; it is a corrupt thing that merits no man's respect. And the Progressives, with their Socialistic collaborators, are—or one or other of the sections of the combination are—asking for the municipalization of everything. Electricity, gas supply, coal, docks, bread, milk, and we know not what. Seize everything in fact, even to the burial grounds that are under private ownership. On the platform, the question of municipalizing the London gas supply has been glided over; perhaps it is thought that is too big a pill to ask the ratepayers to swallow in conjunction with the electricity scheme, which the Municipal Reformers hope to have the pleasure of repudiating, and laying to its final rest. But Mr. John Burns, in his best Napoleonic style, has indicated that he would have no hesitation in roping-in the gas supply with the other public services to be administered by the County Council. "The municipalization of great undertak-"ings like tramways, electric light, gas, and water in this "country has," he said in his Queen's Hall speech in setting the Progressive ball rolling in the election campaign, "led "to a reduction of the rates. By municipalizing these "matters, which in other countries are the monopolies of "employers, we have removed a fruitful source of corrup-"tion and danger such as beset the Anglo-American com-"munities." These being his views, what he would think of the municipalization of the gas supply of London cannot be open to question. We fail to find, however, that the Companies controlling the gas supply are a "fruitful source of "corruption and danger." Mr. Burns, when speaking, had probably so much else on his mind that he inadvertently overlooked the fact that the modern history of civic administration in the Metropolis has brought to public knowledge the existence within it of certain hotbeds of corruption and danger. But of the fact, in his quiet moments, he is cognizant. And still he garbs in spotless white Metropolitan local administration, but accuses the administrators of private enterprise of "jobbery and robbery." Thus does extreme partisanship obscure vision, even of a man of Mr. Burns' power of observation. Let us have fair argument and not abuse from those who are demanding that the productive and distributing industries of London and the Provinces should be vested in public authority, and who, if they obtain supremacy in power, will at once attempt to give an almost immediate corporeality to their theories and ideals. The Municipal Reformers of London hold—and we hold with them—that nothing would be more fatal to the country's commercial power among the nations of the world, and that nothing would be more fatal to the financial security of London, than the subversion of private enterprise and of individual effort, and the setting up in its place, and on a foundation of public finance, of a heavy cumbrous system of management from which individual responsibility, the competitive and creative activity of brains, and personal financial interest—the main impellents in commerce—are entirely absent.

The Progressive-Socialist majority of the County Council have not proved by deeds their efficiency in the management of vast and specialized enterprise; and therefore we are hoping that the coming election will give the death-blow to the ambitious scheme of the at present dominant party for taking in hand, backed by the rates, the entire electricity supply of London and the districts for many miles around. It was Mr. Haldane who the other week, in addressing the British

Science Guild, was dilating on the need for scientific guidance by practical men to produce efficient action. The County Council, as an administrative body constituted as it now is, and as it will be (no matter which party wins the greater authority), cannot possibly have for every form of legitimate administrative work, as well as for every form of productive and trading work that the Municipal Socialists desire to take under their wing, those scientifically-guided practical minds that are necessary for efficient action. To be scientifically guided, or to even dream of being practical, would be repugnant to the mind of the London Municipal Socialist, whose self-esteem really knows no bounds. Their trading work of the past shows it; their schemes for the future are incontrovertible confirmations. For the trading work that has not been successful, they plead for further time, and greater waste of the ratepayers' money. The Council, says Mr. Burns, can no more help the want of success of some of their schemes than the chimney sweep can help the decline in his trade through the growing popularity of the gas-stove. Such a comparison is ill-chosen. Chimney sweeps once thriven because there was a demand for them; some of the Council's schemes, in whole or in part, have not thriven because there has never existed the necessary demand for them to yield compensation and justification.

If one wants to know what high finance really is in local administration, under the benevolent handling of the Progressive Socialists, he should read the book by Mr. John Holt Schooling, entitled "London County Council Finance." There it is seen that the total liabilities of the Council are £74,513,703; the estimated total assets, £29,279,505; and the net debt not otherwise provided for than by future yearly charges for redemption of the debt, £45,234,198. The yearly cost of the interest on the debt has now reached £2,324,000, or nearly £45,000 a week. The estimated receipts on rates account this financial year (including 3 millions the produce of the education rate) is 10 millions, or approximately £190,000 a week; and the estimated expenditure on rates account is £10,106,643, including calculated deficiencies (amounting to £57,911) in revenue producing undertakings. The general *plus* the special rates of the Council were £453 per 1000 of the population in 1890 and £645 in 1907. We are told the men who have been running riot (we do not say all the Council's work has been badly done) among the funds of the ratepayers are "splendid "fellows, with dedicated lives." It will be a fine thing for London and elsewhere if these immaculate and splendid fellows will dedicate their lives to some more useful purpose than imposing such a great and ever-growing strain on the ratepayers of the Metropolis. It is rumoured that if the Progressives and Socialists again get a majority, they are going to introduce a short Act to lengthen their tenure of office from three to seven years; so that, we take it, they may go along uninterruptedly with their grotesque schemes without the intervention of the ratepayers, which is being found so strikingly irksome just now when the Electricity Bill has been introduced. "*Finem respice*" is a motto that the ratepayers should keep well in view during the present campaign.

Co-Partnership in Practice.

Good service has been rendered by the "Standard" in bringing to the notice of the general public (by means of two very readable articles) the exact aims and accomplishments of the South Metropolitan and South Suburban Gas Companies' co-partnership schemes. Of course, those connected with the gas industry are perfectly well acquainted with the matter by this time; but there are doubtless still a large number of other people who understand imperfectly (if at all) the system which has led to these two Companies being regarded—and justly so—as model employers of labour. While so much Socialism is being talked in certain quarters, it cannot possibly do any harm if means (which have been tried and proved workable in practice) are indicated whereby working men may be prevented from becoming the disciples of those who preach this doctrine. The articles to which we refer were written by Mr. L. Cope Cornford, who acknowledges his indebtedness to Sir George Livesey for enabling him to fully investigate the schemes. An explanation of the sliding-scale is followed by the story of the South Metropolitan strike, which arose over the introduction of the original profit-sharing arrangement. On the collapse of the strike, the Company agreed to fill up vacancies with Unionists; but, on the Secretary of the Union declaring that in future the mistake of giving a week's notice would not be repeated—the men would be called out without any notice at all—the Company, in the interests of the consumers, declined to employ Union men. In the case of the South Suburban Company, however (whose co-partnership scheme came into operation some years later), the men were told that they were perfectly free to continue to be members of the Gas Workers' or any other Union; and it is stated that the Union men have come to accept profit-sharing —"disregarding their leaders." The second article deals with the results of the system and its advantages; and what pleasant reading this makes, "JOURNAL" students can well understand. The author concludes with the following recognition of Sir George's efforts to promote the welfare of the employees: "It is not for the present writer to affirm that in the principle so admirably fulfilled in Sir George Livesey's noble achievement lies the sovereign remedy for the present distress; but it would seem at least to be worthy of a very careful consideration. The theory of co-operation is not, of course, new; but the honour of having given the world a signal example of its successful application to a great industrial concern belongs to Sir George Livesey."

Manufacturers and the Rates.

The question of whether the position occupied by corporation stocks, from an investment point of view, has been affected to an appreciable extent by the large capital expenditure of local authorities during recent years, is one that has at different times been keenly debated. Of course, prices have lately been considerably depressed; but this has applied also to other first-class securities, and has not by any means been confined to any one particular branch. There have admittedly been causes for this, quite apart from any considerations of municipal policy; but in a leading article recently, which dealt with the subject of manufacturers and the rates, the "Financial Times" pointed out that, beyond the general factors operating, there were in the case of corporation stocks particular causes tending to a decline in price. "Extravagance in management," it is said, "and continual piling up of debts, especially on trading or semi-sentimental projects, have certainly tended to reduce the credit of several local authorities, while recent revelations with regard to a particular borough have produced anything but a reassuring effect, though these may happily be regarded as quite exceptional. For the first time, indeed, in many years, a shade of suspicion has been cast on the security for municipal indebtedness." While saying this, however, our contemporary does not suggest that at present there is any real reason for uneasiness, but that if municipal borrowing be renewed on a large scale (as there is some indication that it may be) the position will have to be very carefully considered. As showing how the need for caution may arise, attention is drawn to the fact that manufacturers are now exhibiting a very decided tendency to avoid large towns, and seek the advantages of cheap land, low rates and taxes, and freedom from irksome building restrictions and prosecutions for nuisance, which are to be found in the country or in the neighbourhood of small towns. When this policy is carried so far as to entail the removal of existing factories, as has been witnessed in several places of late, the result must, of course, be directly felt by the towns which are thus deserted. Our contemporary says that the mobility of industries was hardly taken into account by the men who built up our huge municipal expenditure; but there are signs that these long-suffering ratepayers are taking steps which may eventually lead to the slow decadence of some large manufacturing towns. It is argued that, with such changes within the bounds of reasonable possibility, the borrowing by municipalities should be very carefully watched; "and it may before very long be desirable to carefully discriminate between the credits of various bodies"—which is already done to a limited extent in the market quotations.

The Work of the National Physical Laboratory.—The Board of Treasury have appointed a Committee to inquire generally into the work now performed at the National Physical Laboratory, with special reference to the character of the tests undertaken there and the lines on which any further development of the work of the laboratory should proceed. The Committee will consist of the Right Hon. G. W. Balfour (Chairman), Sir Andrew Noble, Bart., K.C.B., F.R.S., Mr. W. J. Crossley, M.P., and Mr. R. Chalmers, C.B. Mr. G. C. Upcott, of the Treasury, will be the Secretary to the Committee.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 423.)

AGAIN we have to chronicle no improvement in the general position of things on the Stock Exchange. Business was, if anything, a little quieter than ever, and pretty well every department was terribly dull and flat. On Tuesday, after a gloomy opening the previous day, there was a little promise of amendment. But it soon degenerated into an irregular shifting of ups and downs; and when this had ceased, the downs had it all their own way. It was not the American Market last week that lowered the tone, but a sort of persistent depression, which seemed to affect markets without just cause. Movements of gold were at the bottom of it to a certain extent. The Money Market opened easy with a good supply. But rates began to stiffen after a while; and before the close a shortage was apparent. In the Gas Market, after a fair opening, business became much quieter; and so it continued to slacken, until it became dead-quiet on the closing day. Changes in quotation were few and slight. Having regard to the quantity of excited talk about coal which has appeared in a portion of the Press during the week, and which was almost enough to make people imagine the country is on the brink of a coal famine, it would not have surprised one if timid holders of gas stocks had rushed to realize, and so forced down quotations. As a matter of fact, however, out of six changes in price, three are rises and three are falls. In Gaslight and Coke issues, the ordinary receded a point—stock changing hands at figures which ranged from 98¼ to 96½. A fair amount of business was marked in the secured issues, considering the general quietude all round; and prices were unchanged. The maximum was done at from 91¼ to 90; the preference, at from 108 to 109½; and the debenture, at 84½ free. South Metropolitan was a point easier upon the unsatisfactory report for the half year; but there was very little business done in it. Transactions ranged in price from 128½ to 127. The debenture was done once at 85½. Commercials—which appear from the accounts to have had a good half year, earning their dividend and a nice balance over—were very little dealt in; a couple of bargains in the 4 per cent. at 111 and 112 being the total for the week. The Suburban and Provincial group was hardly dealt in at all. British was done at 42¼, Southampton at 110⅜, and West Ham preference at 123¾ (the quotation advancing a point). On the Liverpool Exchange, Chester improved 1½. The Continental Companies had moderate business. Imperial was adversely affected; transactions drooping from 184 to 181—a fall of 1 in the quotation. Union marked 124, European fully-paid 24½ and 24⅝, and ditto part-paid from 18 to 18½ (a rise of ½ in the quotation). Among the undertakings of the remoter world, Buenos Ayres was marked at 11⅞ and 11⅝, Primitiva at 7⅞, ditto preference at 5 11/16 and 5 13/16, ditto debenture at 95½, River Plate at from 12⅝ to 12⅜, ditto debenture at 96, Monte Video at 12, San Paulo at 13 1/16, and Oriental at 151.

The closing prices are shown in our list on p. 423.

ELECTRIC LIGHTING MEMORANDA.

Public Lighting plus Shop Lighting in Oxford Street—Cost of the Flame Arc Installation—The Danger of Central Standards—New Lamps from America: The "Helion" and an Alloy Filament—Reduced Dividends and Market Values.

OUR electrical friends are highly delighted with the illumination of Oxford Street by the central flame-arc lamps. In their opinion, it is the very *ne plus ultra* in public lighting. But we still claim that, if the Gas Company had been allowed to carry out the lighting in accordance with their tender—not in accordance with the "previous inferior gas lighting" with which comparison is made—there would have been seen a street uniformly lighted, even after the shops were closed and all through the night, at a less cost, with all expenses for the respective lights properly and completely taken into account. Before the shops are closed, Oxford Street presents a striking scene; so it does after the shops are closed; and so it does again half-an-hour after midnight. Oxford Street is unmatched in London in the elaborate character of its shops, and in the extent of the shop-lighting arrangements regardless of expense. Such extensive lighting arrangements—whether by incandescent gas or electricity—supplementing any modern incandescent gas lighting or flame-arc system for public lighting, would make any street during the evening hours look remarkably brilliant. The public lighting of Oxford Street that the electricians are so applauding is therefore the public lighting *plus* the shop-window lighting; and if the cost of getting a similar effect could be computed, street lighting authorities would be frightened of electricity for evermore. If anyone does not believe that it is the shop lighting that contributes largely to what the electricians claim for the new flame-arc lamps, and to the making of the footways and roadway look more cheerful than they otherwise would be between the tall central standards, let that Thomas turn into St. James' Street, Piccadilly, where he will find a few centrally placed flame arc lamps unassisted by shop lighting of the lavish kind that exists in Oxford Street.

As a matter of fact, Oxford Street, judging by the old-fashioned gas-lamps that formerly disgraced it (only £550 a year being spent upon the lighting) before the Marylebone Borough Council decided upon improvement, might, so long as the shop lights did not fail, almost as well remain unlighted by street-lamps. But after the shops are closed, then and then only is properly seen the part that the flame-arc lamps play in the lighting of the thoroughfare. We get, as in St. James' Street, splashes of great brilliance close to the lamps, and shade between; and the effect is deepened by a few very ugly shadows across the road after 12.30, when, for the sake of economy, half the lamps are extinguished. Some dense shadows are also thrown in the side streets. The new lamps—and they will not always remain new—are placed at a height of 25 feet in the air, and are said to possess an illuminating power of 1500 candles each. The latter claim may be taken with a big pinch of salt. If it is 3000-candle power that is obtained from the double-lamped columns, then we are losing knowledge of what candle power is. But whatever the illuminating power, the height at which the lamps are necessarily put—to avoid eye irritation, and to get the best distribution possible from lamps not well adapted for distribution—ought to convince anyone that the ratepayers are not getting in illumination the value that they are paying for. No one wants to climb into the air to enjoy the illumination that is being wasted above; and those ordinary mortals who are content to use the footways, if they know anything of the relation of light to the law of inverse squares, will be aware that the greater distance a light is from a given object, the less the amount of light impinging upon that object—the reduction being in inverse ratio to the square of the distance. Therefore a very large proportion of the £20 13s. 7d. spent annually on each lamp (or double that sum for the two-lamped columns) must, according to that law, be dissipated where it is absolutely without value.

The price charged per lamp or double lamp does not include the capital spent upon the installation. For that expenditure the ratepayers have had to make immediate provision. The initial cost alone has been in excess of the Gas Company's tender for improved lamps by something like £4500. Mr. F. W. Goodenough, the Chief Inspector of the Gaslight and Coke Company, in a letter to the "Electrical Review," states that the installation cost of the arc lamps was estimated at over £3400, with an additional £3000 for mains; while the inclusive estimate for gas was well under £2000. Taking this capital expenditure into consideration, remembering too that one-half the lamps are extinguished soon after midnight (if the same thing had been proposed in connection with gas, it would have made a difference of £200 a year), and considering also that the Borough Council have not regarded this as a "commercial transaction" as did the Gas Company in submitting their tender, it cannot with any truth be said that the relative costs of electric and high-power incandescent gas lighting are in any way demonstrated by the flame-arc lighting of Oxford Street. The estimate for lighting by improved gas-lamps was £1680; the charge for the 81 arc lamps is £1675; but before the Gas Company's tender had been made public, the Electricity Committee hadsubmitted a quotation of close on £1800. If the whole capital expenditure of £6400 is going to be cleared off immediately, adding the cost of £1675 for lighting, the expense of this flame-arc lighting in Oxford Street this first year will be £8075, or £673 per month! On these points, Mr. Goodenough's letter on p. 419 should be perused. Taking a perspective view of the thoroughfare, the high-placed coloured flame arc lights, with (in most cases) two on central columns, have a very showy appearance to the eye; but we do not agree that, after shop-lighting hours, this is a good example of what street lighting should be at the price that is being paid for short-hour lighting, even if we exclude the heavy initial cost. The best thing the electricians can do is to pray—and pray fervently—that no serious accident may occur through the centrally situated columns, and that the machinery at the Borough Council's generating stations may decorously comport itself, so that the whole of Oxford Street may not be submerged in utter darkness, as were the shops supplied by the Council twice near Christmas time.

As London gas and electricity suppliers have been made painfully aware, the new order of traffic has taken a very lively exception to street-lamp standards, even when erected on footpaths and above the road level. What motor cars, motor 'buses, runaway horses, and such like will think of the centrally placed standards in Oxford Street, is something that time alone can reveal. It would be idle to deny that standards centrally situated in roads are not more dangerous than those placed on footpaths, besides affecting freedom in the use of the road. The Manchester Corporation have been brought to an understanding as to the increased danger. There are some central electric tramway standards in the high road from Middleton to Manchester; and on July 13 last a motor car collided with one, doing damage which necessitated an expenditure of £116 for repairs. This was in summer time, yet it was given in evidence, at the Manchester Assizes the other day, that the first of the series of standards was invisible until the driver was within a yard or two of it. At the same spot, a hansom cab was previously injured; and the Corporation had to compromise the claim. In the case of the motor car, the jury declared the Corporation responsible; and the cost of the repairs is to come out of the city's exchequer. The standard, it should be mentioned, was not lighted. We opine that there will be occasions when the Oxford Street standards will not be lighted; and perhaps the Marylebone Borough Council will yet find that the initial, annual, and renewal costs are not the only ones that will attach to the central standards. If so, the estimated expense will, we fear, be a good bit out.

America is not going to let the Continent of Europe have all its own way in the invention of new incandescent electric lamps. There are busy heads and hands over the pond at work to that end; and lamps have been introduced, but with what practical effect has yet to be demonstrated. There is one fresh arrival known as the "Helion" filament incandescent lamp. The right that the lamp has to its title is rather far-fetched. The name "Helion" has been adapted from Helios, and was chosen "on account of the resemblance of the spectrum of the light from this filament to the solar spectrum." It is interesting and pleasant to know this. The lamp is the result of several years' research work on the part of Professor H. C. Parker and Mr. W. G. Clark in the Phœnix Physical Laboratories of Columbia. It is claimed by the inventors that in some respects the filaments are "quite remarkable" as they are not metallic, yet they can be operated at a specific consumption of 1 watt per candle at a temperature which is held to be very much below the temperature of metallic filaments when operated at this consumption. However, the Helion filament is composed largely of silicon, which is reduced and deposited, together with the other materials, under very exact conditions. The base which is being used at the present time is a special carbon filament, on which the necessary deposit is made. The filament is said to give a very white light, has a high luminous efficiency at the normal current density, and is (so it is declared) exceptional in the amount of overload current that it will take without breaking down. There is also the claim made (introduced by the tantalum lamp) that it is possible for the filament to fuse together when ruptured. Judging from the exact and careful conditions that are necessary in the manufacture of the filament, it looks like being a somewhat expensive article to produce; and this is confirmed by the great variation in the results of the laboratory life tests—eight tested lamps showing lives ranging between 485 hours and 1270 hours actual use. The lamps that failed first showed the greatest decrease in candle power (about 15 per cent.); while the lamps that ran the longest only suffered a diminution of approximately 3 per cent. The stated efficiency of the lamp is 1 watt per candle. From observations made up to the present time, the high efficiency of the filament appears "to be largely due to selective radiation, as the filament reaches a maximum whiteness at a comparatively low temperature, after which an increase in temperature to the 1720° point increases the intensity of illumination, but does not appear to make much change in the colour of the light. But with a carbon filament, the colour and quality of the light show a marked change as the temperature increases. Here again, with a lamp possessing so many virtues, there is disappointment for the electricians of this country. The lowest point to which it has yet been found possible to make the filaments is for 30 candles, at a voltage of 100 to 115.

An American patent has also been granted to Mr. J. A. Heany for a metallic filament lamp made of an alloy of tungsten and titanium, or of an alloy of tungsten or some other metal. Mr. James Swinburne in his recent paper did not appear to be greatly convinced that filaments composed of an alloy would be suitable for such lamps, on account of their propensity to melt at a lower temperature than either of the component metals. But this inventor states that he has discovered that certain alloys of certain metals in various proportions are very stable at high temperatures, and appear to have the properties of selective radiation in a vacuum. Here again the production of a filament, according to the description in the patent specification of the processes employed, seems to be a complicated matter; but the result is a filament, composed of an alloy, in a dense shiny, coherent state and homogeneous throughout, with great resistivity, flexibility, and strength. What more can be wanted? There is no information as yet as to life, candle power, voltages, and consumption. But all this from America appears too comprehensively good to be true.

The "Financier" has been pointing to the decline in the profits of the Metropolitan Electric Light Companies—the dividend announcements just made by the St. James and Pall Mall Company and the Westminster Electric Supply Corporation having given our contemporary an unpleasant reminder that the prosperity of these once flourishing enterprises is steadily on the wane. And these are Companies with exceedingly choice districts. The St. James Company are now only paying 10 per cent., as compared with 12½ per cent. for 1905 and 14½ per cent. for the preceding eight years; and the diminished distribution requires £1000 to be taken from the contingency account. The Westminster Corporation have slipped down 2 per cent., by 1 per cent. stages, during two years. The South London Electric Supply Corporation only recommend 3 per cent. on the ordinary shares; being a decline of 1 per cent. The reduced price of current so adversely affected the Smithfield Markets Electric Supply Company that they are carrying forward their surplus profits, instead of distributing them. The London Electric Supply Company continue a 4 per cent. dividend. The Metropolitan Company curtailed their interim dividend; and last year it may be remembered the Charing Cross, the Kensington and Knightsbridge, and the Metropolitan were compelled to reduce the shareholders' participation in profits. Incandescent gas lighting has proved more formidable than the electric supply companies imagined would be the case; and they have had to considerably reduce their prices to meet the competition. They have also, in our opinion (if we may be permitted to form and hold an opinion on things electrical), taken an excessively broad view of the question of differential prices. There is the further fact that more money has to be spent in the district to get new business; and all round the tendency is for the yield to shrink on new capital expenditure. Then there is the dearness of copper and of machinery generally, owing to the higher cost of materials. Coal, again, has been at a higher figure, and will be higher still this year. Therefore, at the moment, prospects do not seem to be in the way of improvement. In conjunction with the reference to reduced dividends, our contemporary also calls attention to the great depreciation of the market value of the Companies' shares. The present prices are as follows (the figures in parentheses being the prices ten years ago): Brompton and Kensington £5 (11 3/16), 8½; Charing Cross, &c., £5 (15), 4; Chelsea £5 (12½), 5¼; City of London £10 (30¾), 10; County of London £10 (16⅝), 9; Kensington and Knightsbridge £5 (13⅝), 10; London £3 (4 1/16), 2¼; Metropolitan £10, (22½), 7½; Notting Hill £10 (20½), 13½; St. James' and Pall Mall £5 (19½), 9½; South London £5 (6⅛), 3; Westminster £5 (18¾), 10. The "Financier" describes the declines as "substantial."

ENGINEER, CONTRACTOR, AND CORPORATION.

A long and important dispute—reputed to have cost each side £20,000 in law expenses—is to be found reported in our "Legal Intelligence" columns to-day. Were it not that, in respect of part of the award of the Official Referee (Mr. Muir Mackenzie), a stay of execution has been granted with a view to an appeal, we should feel at greater liberty to comment upon some of the interesting aspects of the case of *Abram Kellett v. Stockport Corporation*. But as the appeal is applicable, apparently, to only one of the five heads of the plaintiff's claim—namely, compensation for loss of profits, for which he has been awarded the sum of £29,400—there can be no harm in drawing attention to one or two features of this important water-works action.

It took twenty-three days' hearing before the Official Referee to find out some of the facts of the case; and the essential ones are given in our report of his judgment. Here it may be convenient just to give the salient points of the story. Mr. Kellett entered into a contract under a specification and schedule of prices to do certain work for the construction of a masonry dam in the Kinder Valley, near Hayfield, Derbyshire, for the Corporation of Stockport, whose Engineer was (the late) Mr. James Mansergh. As the work proceeded, the contractor came across some faulty beds of shale in the foundations. He drew the Engineer's attention to this, and said he would not be responsible for building upon them. Delays ensued. The designs were altered, and considerable extra foundations were ordered by the Engineer—at that time, Mr. Ernest Mansergh. The alterations very largely increased the original estimated cost of the work. The Corporation took fright at the large increase of cost and sought other advice. They were advised that an earthen dam could be more safely and economically constructed than the masonry one of modified design. More delays ensued. The Corporation allowed the contractor to go on with certain work, withheld from him certain information, and eventually repudiated and stopped the contract. The contractor brings an action for breach of contract, is fully justified on all points, and is awarded £52,546 19s. 1d., and costs. Such is the brief outline of the facts; and it is hardly necessary to add, even from this bald statement, that sympathy must inevitably go out to the contractor. He did all he could—behaving in a frank, honest manner, sending the Corporation copies of his experts' reports on the faulty foundations, and ready always to carry out his part of the contract, which, nevertheless, the Corporation broke and took away from him.

One observation (which we will not now enlarge upon) suggested by this case, is the psychological reason of the moral attitude of a group of men being different from, or lower than, that of the individuals composing the group. It is the same metaphysical problem that presents itself when we find a group of humane men doing a cruel action, or cruel men doing a kind one. Another point concerns the relationship of engineer, contractor, and corporation. In cases such as this, the Official Referee says, in so many words, "The engineer is not the mere servant of the corporation." We believe that this principle could be beneficially extended to a great many other instances—especially in the gas industry. It would, in our opinion, prove of general advantage if many engineers would regard themselves less in the humble light of servants, and more in the higher plane of masters—in all technical matters, the engineering masters of their boards of directors or their committee men. A weak, subservient engineer will only ruin himself, his board, and his company.

Lastly, we think that this Stockport case may be pointed to—among several other instances, and some of which are not very remote in the history of gas affairs—as showing the dire results that may follow from treating the contractor with reserve, not to say suspicion, instead of with openness and confidence. Our view is, and indeed the real and legal view is, that when a contract is entered into between two parties, be they corporation and contractor or anyone else, thereby is established a mutual relationship for the good of both, with mutual rights and duties; and a spirit of "give and take," and of helpful and friendly partnership should be the characteristic attitude and effort of each. If such a proper feeling were more general in all contractual undertakings, it would prove of benefit to the parties themselves and to the community at large.

FLAME v. ELECTRICAL STANDARDS OF LIGHT.

THE resumed discussion, at the meeting of the Institution of Electrical Engineers, on Mr. C. C. Paterson's paper on "Light Standards" and the "High-Voltage Glow-Lamp," of which a report appears on another page of to-day's "JOURNAL," did not add much to what has already appeared with reference to flame standards. A written communication from Mr. A. Vernon Harcourt, F.R.S., was unfortunately not read by the President, who, however, stated that it called attention to one or two points of considerable importance. That being the case, it is difficult to understand why it was withheld from the meeting, and will not be allowed by the Institution to see the light of day until it appears with the report of the discussion in the "Journal" of the Institution—by which time interest in Mr. Paterson's paper will have abated. The President, however, gave some clues to the points dealt with by Mr. Harcourt, and we propose to avail ourselves of these in our comments on the subject.

Mr. Paterson's paper and the discussion thereon have primarily raised the broad issue whether electricians shall accept a recognized flame standard of light, or whether they shall adopt a new electric lamp standard. Now, we have it on the authority of Mr. Paterson, Mr. A. P. Trotter, and other electricians, that it is no use setting up an electric glow-lamp as a primary standard. If, therefore, electricians are content to accept the Harcourt or other flame standard as a primary standard, why is it necessary for them to employ electric glow-lamps as secondary standards? The answer would doubtless be that the flame standard is subject to variations in value with variations in the atmospheric conditions, of which electric lamps are independent. Accepting this contention as broadly correct, it becomes pertinent, however, to compare the probable source and degree of error in photometry due to the use of either standard. We will take the Harcourt standard as our flame standard—merely remarking that some electricians prefer the Hefner, which is somewhat less sensitive to variations in atmospheric conditions.

A flame standard may be affected by (1) vitiation of the atmosphere, *i.e.*, by increased carbonic acid and diminished oxygen content; (2) by variations in the barometric height; (3) by variations in atmospheric temperature; (4) by variations in the degree of humidity of the atmosphere; and, finally, (5) by alterations in its immediate environment—such as would affect the direction or rate of flow of air currents to and from it. Now it must be assumed that no photometry worthy the name will be conducted in any but a properly warmed and ventilated room—*i.e.*, one maintained by hot-water pipes at 60° to 70° Fahr., and with air inlets and extraction flues arranged to renew the air, without perceptible draughts, at such a rate that the carbonic acid present will at no time exceed 8 volumes per 10,000 volumes of air. Such a standard of ventilation is not difficult of attainment even in crowded rooms and theatres. Mr. Paterson admits that no candle-power difference is observable with the Harcourt standard when the variation in the proportion of carbonic acid is restricted by about such a maximum. His remark apparently applied also to the effect of the corresponding diminution in the proportion of oxygen. Thus with a reasonably well ventilated photometer room, vitiation of the air is a negligible factor with the Harcourt standard. Similarly temperature changes (although entirely disregarded by Mr. Paterson), if within a range of 10° Fahr., may be disregarded, since a photometer room should be provided with proper heating arrangements. The degree of humidity, moreover, will be subject to relatively small changes if the room is kept at a temperature of 60° to 70° Fahr., and occasional excessive dryness rectified by obvious means. It is easy, however, to observe the degree of humidity, and when necessary to correct (according to the now established formula) the value of the standard flame. The one practically uncontrollable condition is the variation of the barometric height; and for this a correction must be made according to the formula, in cases where the light under test is an electric lamp, which is presumably unaffected by the variation. The fifth source of variation can obviously be excluded without difficulty.

Given the observance of the reasonable precautions indicated, it is clear that the only variations in the value of the Harcourt standard will arise from variations in the barometric height and less often from variations in humidity, for both of which corrections are easily applied. There is no other known source of variation; and, most important point of all, the standard is unaffected by lapse of time. It is a matter of common knowledge that Harcourt lamps have been in daily use in London gas-testing stations since 1898—that is to say for over eight years—with a use underestimated at (say) 5000 hours; and it does not appear to have been alleged that they have so far departed appreciably from their original value. They started—we believe after due verification by the Metropolitan Gas Referees—as primary standards, and remain in use to the present day equally reliable as at the outset, and not differing one from the other.

In regard to electric glow-lamps as standards, it is true that they are independent of atmospheric conditions, except temperature to some extent, and possibly, to a negligible extent, barometric pressure. It would be useful if the variation which atmospheric temperature undoubtedly gives rise to were accurately determined. Their value, however, must be determined by comparison with some primary standard, such as the Harcourt lamp; and, even with every precaution in manufacture, it does not remain constant. Let us listen to what Mr. Paterson has to say about the Fleming-Ediswan low-voltage standard lamps—admittedly the best electric standards prepared. He examined ten specimens for periods varying from 400 to 600 hours. The efficiency was initially about 4·5 watts per candle, and 4·3 watts after 500 hours. A drop of over 4 per cent.! The best curve obtained is that of one lamp which remained constant for 200 hours! Mr. Paterson goes on to say:

> "The first point which is evident from an inspection of these curves [of the candle-power of the lamps over a period of 600 hours] is that the performance of filaments specially prepared for constancy cannot be predicted with certainty. If a lamp is to be used as a photometric standard of the first grade, its history for 100 to 200 hours should be known, and its life curve should be closely watched in order to ascertain the point at which it is beginning to flatten out. . . . A properly aged specially prepared low-voltage filament if burnt for, say, ten minutes a day for five days in the week should last two or three years without changing the half of one per cent. in candle power, provided that no excess voltage is applied."

That is the best that Mr. Paterson can say for electrical standards of light. If electricians find such limited use of a standard of light adequate for their requirements, and rest content in the knowledge that it is at best a secondary standard, we may refrain from any comment on the purpose served by their photometrical labours. We are satisfied, however, that many will prefer a more durable and less capricious standard, even though it be of the flame type. It is open to them, if they waive their objections—mostly unreal—to a flame standard, to obtain in the Harcourt lamp (or in the Hefner lamp, if they prefer the smaller unit) a primary standard, as durable and as trustworthy as the primary standard which would be used for the standardization of the electric secondary standards which the National Physical Laboratory apparently desire to exploit.

MOTOR VEHICLES AND TARRED ROADS.

AT the Institution of Civil Engineers last Tuesday evening, a paper, on "Modern Motor-Vehicles," by Colonel R. E. B. Crompton, was read and a discussion upon it begun. The subject is a very topical and important one—appealing as it does to everyone, especially the "man in the street." Although gas engineers are thus interested in it like everybody else, there are at least two aspects of the subject which concern them in a particular degree. The first, of course, is in the matter of road-construction and the use of gas-works' tar; the second (of lesser importance) is the adopting of steam motor-waggons for their own purposes, and the use for them of gas-works' coke. Before dealing with these two items, it may be of interest to give a short general outline of Colonel Crompton's paper.

The universal interest in the matter of motor-vehicles is indicated by the columns devoted to it in the Press, and the fourteen technical journals relating to it. Of commercial vehicles alone, it is calculated that in the year 1905, the output was 3500; their value being computed at £1,250,000. The author calls to mind that the road locomotive was antecedent to the railway locomotive; and he refers to early English engineers (like Hancock and Gurney) who brought the road engine to a practical stage of working between 1820 and 1835. Colonel Crompton does not make any mention of our own William Murdoch; but we believe it is the gas historian Matthews, who affirms that the inventor of gas lighting also astonished people by running his "little steam carriage" along the road. Upon what evidence this statement is made, we are unaware; but it is certainly of interest in linking together the gas and motor industries in the inventive brain of a common pioneer. Mr. W. W. Beaumont, who opened the subsequent discussion, also called attention to the advanced stage of mechanical efficiency to which these early engineers brought their motor carriages—notwithstanding the fact that they had to work with tools far less numerous and perfect than are at our disposal to-day. Colonel Crompton makes it clear that these early road locomotives disappeared, not through mechanical defects, as is commonly supposed, but solely owing to their being driven off the roads by other and conflicting interests. Had this been otherwise, what might not have been the state of road locomotion at the present day? After steam ploughing-machines, came agricultural portable and traction engines. Then, in 1885, the modern era started with the Daimler motor and petroleum spirit. The author then considers the general arrangement of motor mechanisms, the driving power required (incidentally remarking that, though Watt's 33,000 foot-pounds per minute was the standard 1 H.P., it was only the average power, and a horse could exert for an appreciable time up to 250,000 foot-pounds per minute), the rolling and air resistances, wheel construction, tyres, gearing, steering, skidding, fuel, and costs of working. All of this is in Part I. of the paper; Part II. consisting of specifications and working costs of various types of vehicles. Altogether, it is a very complete and useful summary of a vast subject, though perhaps all the data are not to be unreservedly accepted.

Let us now look at what is said about roads, which particularly interest the gas engineer. The railway locomotive designer has only to consider his engine; for the railroad is regular. Not so the motor designer; for his roadways are various. Practically,

all the improvement so far has been made in the motors, and very little indeed has been done to the roads. Road authorities have fallen into a false sense of security owing to the many years that their roads have been subjected only to light traffic. They have used faulty materials and faulty methods; and now all this must be changed with the greater number of vehicles using the highways. Water cannot any longer be relied upon as the means of holding together the top of the road. Water as the binding medium has led to excessive camber being given to the roads—12 inches in a roadway 24 feet wide; whereas if some waterproof material were used on the surface, the camber could be reduced to 4 inches, with two straight slopes starting from the centre line of the road. There might even be only a single rise of 4 inches—all surface water draining away to one side. The result would be less wear of the wheel and of the road, less noise, less dust, and less cost of maintenance. But to keep the road in a monolithic condition, the particles must be combined by something which will not evaporate.

It was Mr. E. P. Hooley, the County Surveyor of Nottingham, who first of all suggested the impregnation of hot blast-furnace slag with distilled tar. Colonel Crompton says: "The tar, which is so abundantly produced at gas-works, is cheap, and is readily obtainable all over the country; and if, as has been done by several of the more enlightened among the surveyors, it be properly toughened by distillation and by the addition of suitable tempering materials, it acts very efficiently as a binding material under English climatic conditions of temperature and moisture." Thus a new ideal in road construction can be reached; for tar can be so tempered as not to be too soft in summer, nor too hard or brittle in winter. Tar so used should impregnate the top 4 inches of road metal, which would thus be waterproof. Side-slip or skidding would be diminished; and the cost of maintenance of both road and wheel would be reduced. Even merely painting or spraying the road-surface with tar has produced extraordinary results. The rolling resistance is lessened; and the tar-toughened road has fewer serrations—consequently producing less tremor, noise, and vibration.

In his after-remarks, Colonel Crompton said that the co-operation of road engineers was essential, if success along these lines was to be attained. He also drew attention to there now being a private fund for a large-scale experiment, to show whether something other than water ought not to be used for binding road material. We venture to think that this important matter is one that might commend itself to the Institution of Gas Engineers; for surely the hearty co-operation of all gas engineers and managers should be secured in finding a new outlet for their tar, and in assisting towards the ideal dustless road. Is there not a National Dustless Roads Committee in existence, which might be approached, if this has not already been done?

A brief word must suffice for our second point of gas interest—namely, the use of, and fuel for, steam motor-waggons. Whether horse haulage for coal or coke services in connection with gas-works should be replaced by mechanical traction is a question to be decided upon the merits and conditions of each case. The author of the paper works out the costs of running nine different vehicles; his Table VII. being the one of most interest to us, as it relates to a 6-ton steam-waggon, using gas-coke, and drawing one trailer—the maximum load being 10 tons. It is, moreover, we are glad to note, practically the lowest in the cost of working per net ton-mile—amounting to only 1½d. The average daily mileage is taken at 50 miles; the number of working days per year at 275 days; and the average annual mileage at 13,750 miles. The other items are made up as follows:—

	Per Annum.	Per Mile.
Wages (driver at 40s., lad at 15s. per week)	£143 0 0	2·50d.
Fuel (gas-coke, 65 tons at 8s. per ton)	26 0 0	0·45
Lubricants (48 lbs. grease at 10d.; lubricating oil, 60 gallons at 1s.)	5 0 0	0·09
Maintenance and depreciation	100 0 0	1·74
Rent of waggon-shed	25 0 0	0·44
Insurance (fire and third-party)	25 0 0	0·44
Water	3 10 0	0·06
Licence and sundries	5 10 0	0·09
Contingencies	7 0 0	0·12
Total	£340 0 0	5·93d.

With an average load of 8 tons one way, or 4 tons both ways, the cost per ton-mile of load, as we have already said, comes out at 1·5d. No doubt, the price of gas-coke is taken at a low figure; but the various items of cost may prove useful as a guide to any who contemplate changing their haulage system.

Professor J. Wertheimer, the Principal of the Merchant Venturers' Technical College, Bristol, who, as our readers may remember, recently carried out an exhaustive series of experiments on divining for water, has received the Order of Officier d'Académie from the French Republic.

The Council of the Society of Arts attended at Marlborough House on Friday, when the Prince of Wales, the President of the Society, presented the Albert Medal to Sir Joseph Wilson Swan, F.R.S., "for the important part he took in the invention of the incandescent electric lamp, and for his invention of the carbon process of photographic printing."

PERSONAL.

Mr. J. MACKENZIE has resigned his position as Gas Manager to the Marple Urban District Council. He asked that the resignation might take effect by the end of the present financial year, March 31.

Mr. A. WEBB has been appointed Works Manager of the Calne Gas and Coke Company, Limited, and will take up his duties next Monday. Mr. Webb at present occupies the position of Foreman at the Chippenham Gas-Works.

Mr. J. W. M. RICHARDSON, Assoc.M.Inst.C.E., has just been appointed Water Engineer to the Birkenhead Corporation, at a salary of £400 per annum. Mr. Richardson has been acting in this position since 1901; and even before that date he did the bulk of the work falling to the lot of the Water Engineer. In moving the appointment, Alderman Bloor said the Water Committee's previous inaction in the matter had been in consequence of not knowing exactly their position, in view of the negotiations with Liverpool and the scheme in hand to procure a supply of water from Wales. Mr. Richardson was fully qualified to discharge all the duties that would be required of him. No one was more conversant with the details of the works, both as regarded the machinery above the ground and the strata below.

OBITUARY.

The death occurred on the 2nd inst., of DMITRI IVANOVITCH MENDELÉCFF, the eminent Russian Chemist, who was universally famous as the enunciator of the periodic law of the chemical elements. He was Faraday lecturer to the London Chemical Society in 1889, when he delivered a memorable discourse on this subject; and in 1905 he received in person the crowning honour at the disposal of the Royal Society, in the shape of the Copley Medal. Deceased was born at Tobolsk in 1834, and received his education at the gymnasium, of which his father was the Director.

In the "JOURNAL" for the 22nd ult., the death was announced of M. Aimé Wautelet, who was described as the Manager of the Roubaix Gas-Works. We learn that it was one of the sons of this gentleman, bearing the same Christian name as his father, of whose decease news reached us. We regret exceedingly the error into which we were led by this coincidence; and with the apologies we offer to M. Wautelet for its occurrence, we unite our sincere sympathy with him in the loss he has sustained.

Competition for the Best Tar for Road Making.

The Roads Improvement Association have issued the rules for a competition for the best preparation of tar suitable for road purposes. The competition is supplementary to the one for the best tar-spreading machine, the rules for which, as previously mentioned in the "JOURNAL," have already been published. The chief object of the competition is to ascertain the cheapest method, consistent with efficiency and effectiveness, of treating crude tar—not necessarily the refined or distilled article—to make it suitable for use upon roads. The considerations which will weigh with the Judges in awarding the prizes are set out fully in the rules under the following headings: Cost, ease of application, efficiency, dust-preventing capacity, insolubility, weatherproofness, power of adhesion, time required and effectiveness of setting, and freedom from harmful or offensive constituents or qualities. The preparation which is adjudged the best will be awarded the Ballymena 100 guineas trophy, placed at the disposal of the Association by the Ballymena Woollen Factory, Limited, and also the gold medal of the Association. The Judges appointed by the Council of the Association are the same as those selected for the tar-spreading machine competition; and they include Mr. H. P. Maybury, M.Inst.C.E., the County Surveyor of Kent, and Mr. W. J. Atkinson Butterfield, M.A., F.I.C., F.C.S. The cost of the competition will be borne by the Automobile Club and the Motor Union. Further particulars, together with a copy of the rules, can be obtained on application to the Hon. Secretary of the Association, Mr. Rees Jeffreys, No. 1, Albemarle Street, Piccadilly, W., who will be glad to receive the names of tar distillers and others willing to enter for the competition. The last day for entering is the 31st of March.

The many friends of Professor Smithells who are readers of the "JOURNAL," will, we are sure, unite with us in expressing sympathy with him in the severe bereavement he has sustained by the death of his wife, which took place last Thursday.

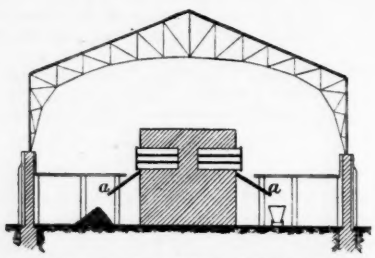
Sir Alexander Binnie, M.Inst.C.E., has consented to become one of the Vice-Presidents of the Association of Engineers-in-Charge. The President (Mr. W. T. Hatch, M.Inst.C.E.) has been elected a patron of the forthcoming Engineering Exhibition at Olympia, and the Association will be further represented by the election on the Advisory Committee of Mr. A. E. Penn, the Chairman of the Educational Committee, and of the Hon. Secretary (Mr. Capsey).

EXPERIMENTS WITH COKE-HANDLING PLANT.

By E. Körting, of Berlin.

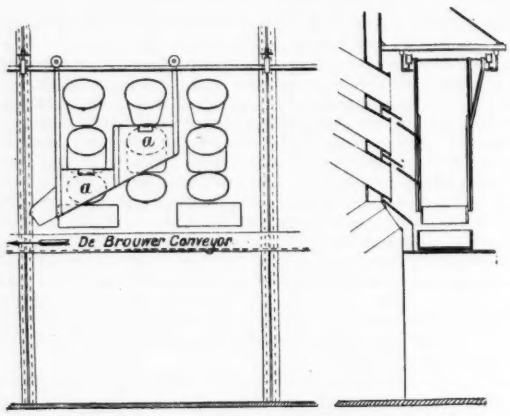
A Study of the numerous gas-works to be found in a large city is often instructive, inasmuch as they show the manner in which the gas industry has developed up to the present time. For instance, retort-settings and coke-handling plant at (let me call it) Gas-Works H have remained practically in the same condition as they were sixty years ago; while Gas-Works S has a typical example of the gas-fired settings originally introduced about 1880, and two other works, G and M, contain Coze settings and De Brouwer conveyors—thus representing more modern developments. Thus, if the two plants M_1 and M_2 are compared with G, a good idea may be obtained of the manner in which experience has led to the introduction of machinery. The different methods of working may be advantageously compared from three distinct points of view—according to their effect upon: (1) The character of the coke; (2) the consumption of energy and labour; (3) the cost of maintenance.

It cannot be denied that the original method of working, where the coke was drawn out of direct-fired retorts on to low trucks, and the latter were emptied outside the retort-house by a gentle tipping action, was highly successful in preventing any breakage. A much greater demand on the strength of the coke is made by the high gas-fired furnace shown in the illustration marked S; for, as a rule, the coke, drawn out of such retorts in small quantities, falls first on the sloping plane marked *a*, and then drops either on the floor or into a narrow-gauge truck—*i.e.*, is twice exposed to a somewhat severe shock.



Cross Section of Gas-Works S Retort-House.

Finally, in the case of mechanical working, it is necessary to distinguish between what happens in the conveyor and in the coke-store. The coke is liable to suffer (1) by falling into the conveyor, (2) by being agitated while in the conveyor, (3) by falling out of the conveyor, or from one conveyor to another, and (4) by being disturbed in the storage vessel. The first source of injury is greatly reduced by the use of the sliding conveyor (see Illustration Gr) put on the market by the Berlin-Anhaltische Maschinenbau Actien Gesellschaft, whereby the height from which the coke falls and the concussion to which it is exposed are greatly diminished. Agitation while in the conveyor seems to have little or no bad effect upon the coke. Transference from one conveyor to another does a good deal more harm; for in that case a comparatively thin stream of coke is constantly falling on to a hard surface. The amount of injury done can be diminished, though not entirely avoided, by keeping the conveyor always as full as possible, as is easy to effect in the case of Coze



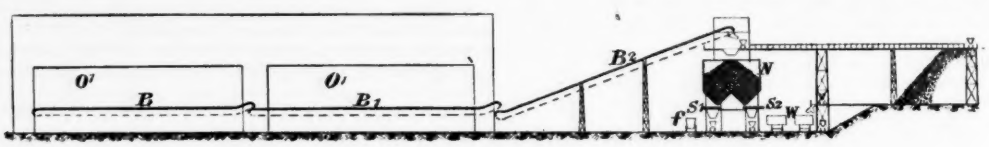
Arrangement G_2—The Adjustable Coke Shoot.

retorts, vertical retorts, and horizontal retorts discharged with a ram. Even the filling of large storage vessels with coke is an operation of some difficulty. A thin stream of coke ought not to be allowed to drop by itself out of the conveyor, but in all cases a small receptacle full should be allowed to accumulate and then be emptied all at once. A fall of considerable height is never advantageous.

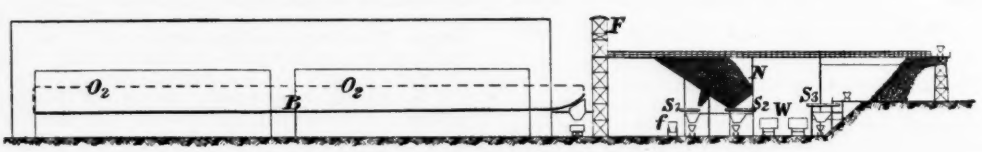
The illustration marked M_1 shows diagrammatically the first method adopted by Gas-Works M for handling the coke mechanically. It will be observed that there are three separate conveyors—that is to say, that the coke is disturbed two or three times; while the storage vessel N is of great depth. The plant should be compared with that shown in the illustration M_2, which indicates the newest form of apparatus. Here only one conveyor is employed, which, in spite of its great length, has worked up to the present time without giving any trouble; while, moreover, its length can be reduced to one-half in a few hours' time if the furthest bench of retorts is thrown out of action. Under the sloping part of the conveyor (see Illustration M_{2a}) a small intermediate hopper is arranged, and above it the floor of the conveyor is broken away. Thus a sliding plane is provided down which the coke falls quite gently. From the hopper, trucks are filled, raised on the lift, and emptied into the main coke-store. The latter is also provided with a sloping wall on the side nearest to the elevator, so that here again a gentle declivity is provided for the coke to slide down. Underneath the storage vessel sieves S are provided, so that the coke falls into the truck W or the conveyor F in a perfectly clean state; while the smalls are sorted once more.

In Gas-Works G, it was found impossible, for local reasons, to construct the conveyor in a single length. Moreover, owing to the very high pressure on the conveyor at certain times, the coke could not be screened underneath the main storage vessel. It was therefore necessary to erect above it a long sorting apparatus, with accessory conveyors for grading all the coke made. The sloping side wall of the store was therefore arranged under the extreme end of the conveyor, so that coke had again an inclined plane to roll down, whatever the direction given it by the opening of appropriate dampers.

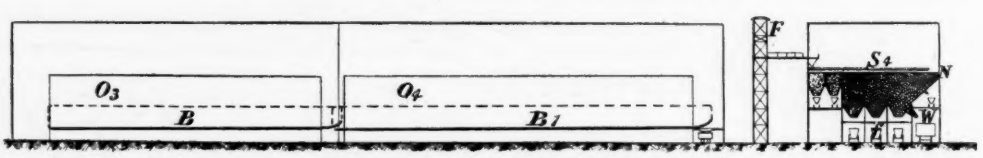
In order to ascertain the effect produced on the coke by the different arrangements for handling it which have already been



Arrangement M_1—Old Mechanical Plant in Gas-Works M.

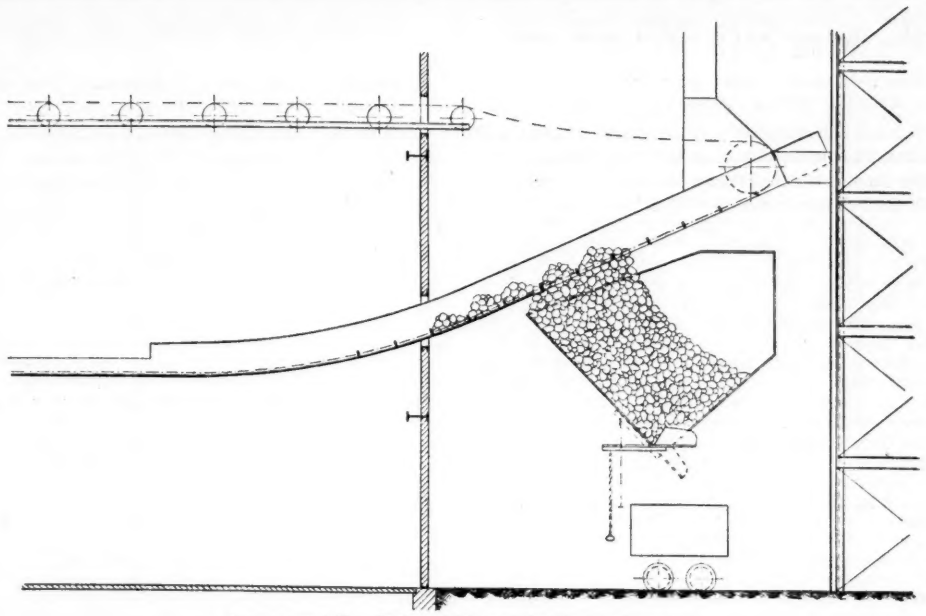


Arrangement M_2—New Mechanical Plant in Gas-Works M.



Modern Mechanical Plant in Gas-Works G.

O_1 Eight Benches of Coze Retorts. O_2 Nine Benches of Coze Retorts. O_3 Ten Benches of Coze Retorts. O_4 Thirteen Benches of Coze Retorts. B B_1 B_2 De Brouwer Conveyors. N Night Hopper. F Lift for Coke Trolley. S_1 Rocking Sieve for Carts. S_2 Rocking Sieve for Waggons. S_3 Rocking Sieve for Storage Coke. S_4 Rocking Sieve for Sorting Coke.



Arrangement M_2a—Enlarged View of the Sloping Conveyor.

described, experiments were carried out for considerable periods of time—*i.e.*, for at least six months—at the different works; the quantities of coke of various sizes being accurately determined. A distinction was drawn between the amount of dust produced by the action of the breaker and that by the handling plant. Calculated per 100 kilos. of coke leaving the retort-house, the figures obtained are shown in the accompanying table:—

		H. Direct Fired Retorts Worked by Hand.		S. Gas Fired Retorts Worked by Hand.		G. Coze Retorts and Conveyors.	M. Coze Retorts and Conveyors.
Large and small coke		92·9		86·9		90	90·1
Dust less than 15 mm. in size	made by removal	2·7	7·1	9·0	13·1	10	9·9
	made by breaker	4·4		4·1			
		100		100		100	100

It should be stated that the coal carbonized on Gas-Works H was almost entirely English, and that only a small store of coke could be kept there; whereas in the other factories large quantities of Silesian coal were also consumed, the coke from which passed through the plant.

It will be seen that there is hardly any difference in the proportion of coke accidently broken on works where gas-fired retorts are worked by hand and Coze retorts are fitted with De Brouwer conveyors—more particularly so when it is remembered that the mechanically sorted large coke from Gas-Works G and M is much cleaner than the forked-coke obtained in Gas-Works S. On the other hand, direct-fired retorts give a coke remarkably free from dust, especially when English coal is carbonized. This advantage, however, is not so great as it might be, because, even when the market conditions for the sale of large coke are as favourable as is the case in Berlin, there is nevertheless always a demand for smalls. When the latter cannot be separated by screening, as is the case in Gas-Works G and M., a coke-breaker must be used, which naturally produces a good deal of extra dust. It may, therefore, be said with perfect propriety that machine labour on a gas-works does not exert an unfavourable influence upon the coke.

A comparison between the three different varieties of handling plant is also instructive. On its way from the retort to the waggon or the conveyor, the proportion of large coke, small coke, and dust recovered from 100 kilos. of original coke obtained on carbonizing roughly equal parts of English and Silesian coal is shown below.

	M_1.	M_2.	G.
Large coke	68·5	78·0	72·3
Small coke	22·0	14·1	18·2
Dust less than 15 mm. in size	9·5	7·9	9·5
	100	100	100

It will be evident from the figures relating to Plant M_2 that the mechanical conveyance of coke gives most excellent results.

In the following table are recorded the average outlay on wages and power per 1000 kilos. of coke transferred from the retort-house or store into the railway trucks, barges, boiler-house, &c., or from the retort-house to the store in the five gas-works referred to.

Gas-Works		H.	S.	G_1.	G_2.	M.
Wages	M.	2·33	1·98	2·36	1 08	0·69
Power	,,	0·01	0·06	0·06	0·08	0·09
	M.	2·34	2·04	2·42	1·16	0·78

The economical superiority of the mechanical handling plant is at once manifest. It has now to be seen whether the economy in wages may not be neutralized by high maintenance charges. The mechanical plant on Gas-Works M was brought into operation in the autumn of 1901, since which time costs per 1000 kilos. of coke moved and made ready for sale have been as follows.

	1902.	1903.	1904.	1905.	1906.
Conveyor	—	—	0·18	0·21	0·17
Screening	—	—	0·14	0·11	0·17
Total	M. 0·23	0·19	0·32	0·32	0·34

The last item in the year 1906 of 0·17 mark includes the expense of painting the overhead store. The cost of maintaining the coke-handling plant in Gas-Works G during its first year of employment was a good deal lower still—being only about 5 pfennige per 1000 kilos. Unfortunately, the cost of maintaining the coke-breaker and screening plant and the numerous sums expended on wheelbarrows, forks, &c., in the days of hand labour were not entered separately on the books. An approximate calculation of these items on Gas-Works G before the introduction of handling plant shows that they should have amounted to some 16 pfennige per 1000 kilos. Hence the cost of keeping the machinery in good condition does not in any case appreciably increase the expenses involved.

The correctness of this opinion is borne out by the fact that during the last four years the total cost of keeping the buildings, machinery, retort-settings, railway lines, &c., in good condition, together with all the repairs requisite, has been sensibly identical in all the four gas-works under consideration, whether they were constructed on old or new lines. The repairs effected on Gas-Works M, moreover, cannot be considered as brought to the lowest point possible. The chief source of interruption and of expense on Gas-Works M was the rising conveyor, a piece of apparatus which is not found in the new plant M_2. In the latter case, a single conveyor replaces a treble one. Again, the costs of maintaining a conveyor are also diminished by improvements in its construction—by making its various parts stronger and its carrying surfaces of interchangeable cast-iron plates.

The side walls of the overhead coke-store are no longer built of thin plates of iron, but of thick planks of wood—experience having shown that the latter last much longer. There are therefore good grounds for asserting that the costs involved in using mechanical handling plants may be brought down to almost the same figure as when hand labour is employed. The excellent results obtained during the first year when the new plant on Gas-Works G was in use—viz., 5 pfennige per 1000 kilos—bear out this assertion.

From the figures that have been given above, it is quite evident that, when conditions are such as generally obtain in Berlin (or more correctly speaking such as obtain at the works discussed), the adoption of coke-handling plant introduces notable industrial advantages which justify the extra amount of capital necessary for their construction being sunk in them.

Mr. Councillor Edwards, who has just been elected an Alderman by the members of the Leicester Town Council, is well known to readers of the "JOURNAL" as the Chairman of the Gas and Electric Lighting Committee. By his great devotion to the interests of these important departments of the Corporation, Mr. Edwards has certainly deserved the honour which has thus been bestowed upon him.

"MONARCH" (PLAISSETTY) SOFT MANTLES.

Our readers have been made aware, from descriptive articles published in the "Journal," that, in connection with the Plaissetty system of mantle manufacture, entirely new ground has been broken—from the genesis of the mantle to the present stage. Plaissetty's invention itself introduced novelty; and since then there have been several improvements which have been departures from the ordinary lines of mantle making. The race at the present time among those interested in mantle production is—not so much with the object of getting the mantle itself to contribute more than it can already do in the development of illuminating power under proper treatment, but with the object of imparting to the mantle greater durability and resistant power. And it is with this primarily in view that those whose concern it has been to evolve a greater perfection from the Plaissetty mantle have taken a unique step. They have by dint of great perseverance, investigated the problems that required solution in order to give direct to the gas consumer a mantle that could be handled as safely as any other soft textile material, and that would not need any special burner or high-pressure gas for burning off, but be simply treated in the usual way on an ordinary burner. What has been done in this matter was fully described in the "Journal" for March 6 last (p. 637) and April 17 (p. 169). There is no occasion, therefore, to define the actual developments further. At that time, criticism was made of certain details associated with the new soft mantles—not only in our columns but by others who put the mantles to trial. The interval has been spent in minimizing the incidental disadvantages then found; and now it is considered by those who have been busying themselves in this direction, that they can come before the public with a more perfect mantle, in both inverted and vertical form. To this end, the Combined Incandescent Mantles Syndicate, Limited, has been formed; and from it it is proposed to form a Company, with a capital of £250,000, to acquire "the benefit of all contracts, patents, plant, machinery, and a freehold works in an immediate London suburb, where the Plaissetty mantles are at present being manufactured." Mantles, incorporating the principal changes that have been effected in the original system of manufacturing the Plaissetty mantle, are also made in the customary collodionized form; and the Welsbach Company are selling these on royalty.

But regarding the soft mantle, the advantage, of course, starts with their pliability. They can be crushed up in any manner without detriment to their structure; and as now supplied, they are packed in flat circular-shaped boxes or envelopes which occupy little room, and are not so awkward for packing as the old long cylindrical shaped boxes. However the mantle is dealt with, there cannot be, without being purposely torn, any fracture in them when placing them on the burner, nor are they subject to destruction in the process of installing them in position. On being burnt off, the mantle adjusts itself perfectly to the flame of the particular burner upon which it is being used, whether the gas is being supplied at the lowest or at the highest point in the range of common or local pressures. It is most remarkable what variations in the shapes of flames are found with various burners—both upright and vertical—and even with different burners of the same type; and therefore the form of the mantle must have some effect on the amount of incandescent surface obtained. If the mantle does not fit the flame perfectly, there must be portions of it that are not incandescent; and a spotted mantle—that is to say, a mantle not fully incandescent—is a most undesirable thing. When, too, the mantle has adapted itself to the flame, the homogeneous character of the constituent filaments, it is claimed, prevents any further shrinkage. We have referred to one disadvantage of these mantles before, and we do not see that it is to be overcome, in using the flame of an ordinary burner for destroying the combustible part of the mantle—that is, the fact that time is involved before the consumer develops the maximum illuminating power. The illuminating power derived from the mantles is an ascending quantity for some hours; but when it has reached its maximum, it is maintained, with ordinary attention to the burner, for considerable periods. In addition to the question of preservation from injury prior to use, and the adaptability of the mantle to any shaped flame, whether at high or low pressure, or whether the burner is of an expensive or of a moderate or low-priced type, additional strength is claimed for the soft mantle.

At the present time, an exhibition of the mantles on various burners is being made at No. 3, Wellington Mansions, Buckingham Gate, S.W.; and there anyone can have an opportunity of judging the effect upon different types of burners. Of course, the mantles used on good burners give an excellent light; used on indifferent burners, there is a great depreciation of the light value. However good a mantle, one cannot do it justice if the conditions of use are not good; but what the Syndicate claim is that, given a bad burner, a mantle that can adjust itself to the flame will do better than a non-adjustable one. In claiming this, however, they are not advocating bad burners; but they know the propensity of certain gas consumers for cheapness. The mantle has slight disadvantages; but the advantages, it is expected—by those who are promoting the commercial exploitation of the mantle—will, in the eyes of users, completely annul those disadvantages. The soft mantle is to be known as the "Monarch;" and it is being made in all sizes for all types of burners.

JUNIOR INSTITUTION OF ENGINEERS.

The members of the Junior Institution of Engineers had their annual dinner at the Hotel Cecil on Saturday night; and, in accordance with precedent, they and their guests derived a considerable amount of pleasure from the event. The President (Mr. William B. Bryan, M.Inst.C.E.), the Chief Engineer of the Metropolitan Water Board, was in the chair; and professional eminence was strong both on his right and left hand sides. The Legislature was represented by the Right Hon. Lord Farrer, and Mr. E. B. Barnard, M.A., M.P., the Chairman of the Works and Stores Committee of the Metropolitan Water Board. Among the numerous company were also Sir Alexander Kennedy, the President of the Institution of Civil Engineers, Sir R. Melvill Beachcroft, the Chairman of the Metropolitan Water Board, Mr. Charles Hunt, the President of the Institution of Gas Engineers, Mr. Dugald Clerk, the President of the Society of British Gas Industries, Dr. Glazebrook, the President of the Institution of Electrical Engineers, Mr. Samuel Cutler, sen., Mr. Samuel Cutler, jun., Mr. Lewis H. Rugg, the Chairman of the Junior Institution of Engineers, and Mr. W. T. Dunn, the Secretary. Succeeding the loyal toasts, the President proposed "The Houses of Parliament." He spoke of his thirty years' experience as a witness before Parliamentary Committees; and he asserted that the Committees of both Houses brought a large amount of ability to bear upon their work. Referring to the busy life led by Mr. Barnard, who was to respond for the House of Commons, he mentioned that he was Chairman of the Works and Stores Committee of the Metropolitan Water Board, who had cast upon them the duty of supplying about 7 millions of people with an adequate quantity of pure and good water. At the meeting when he (Mr. Bryan) entered upon his duties as President of the Junior Institution, a railway engineer who was present told him the average weight of merchandize carried in a truck. A mental calculation showed him (the President) that one day's output of the Metropolitan Water Board would fill between 700 and 800 miles of railway trucks. Lord Farrer, in the course of his reply, showed that, from personal observation, he held the opinion that too severe specialization in engineering is not good, and that the training of an engineer should be based on wide and broad views. One point from Mr. Barnard's speech was that he should like to see at the head of the Local Government Board a man of the highest talent, so that when professional engineers went before him, they would be before a man of their own calibre. That was not the position at present. The toast of "The President and the Junior Institution of Engineers" was in the hands of Mr. B. A. Raworth. There were many interesting points in the President's acknowledgment; one being that the consumers of London only paid 1s. 1¾d. per ton for water. He also stated that, when the Institution invited him to be President, he felt a great deal of diffidence about undertaking the office, as he feared it would absorb more time than he could spare from his work. But he had not felt the position at all irksome, owing to the great courtesy and help he had received from Mr. Dunn. He also spoke of the very prosperous condition of the Institution. Mr. Rugg proposed "Our Guests," and, in the course of his remarks, mentioned that Sir Alexander Kennedy was the first President of the Institution in 1888. Sir Melvill Beachcroft, fresh from electioneering work in connection with the London County Council, was troubled over the question of the rates. He stated that the Metropolitan Water Board paid no less a sum than £400,000 a year in rates, or 13½ per cent. on their gross income, and something like double that on their net. He sometimes thought the Water Board ought to do what the Gaslight and Coke Company did—state on their demand notes how much of the amount was represented by general rates. The Board left themselves very largely in the hands of their Engineer; and it would be hard to find the equal of Mr. Bryan for the great work for which he was responsible. Sir Alexander Kennedy, referring to Lord Farrer's remarks, considered that there was no greater mistake than severe specialization in engineering; and he urged junior engineers to take an interest in every branch of the profession, as well as the one to which they were to specially devote themselves. They could not make themselves engineers in every branch; but they were better engineers in their own branch by knowing something of what was done in others.

If proof were needed of the value of a judicious combination of good typography with photographic illustration in the production of a trade catalogue, it would be found in the one for the current year which is being sent out by Drakes Limited, of Halifax and Leeds. It is of convenient size (9½ in. by 7 in.), and the illustrations which fill its 170 pages are taken from photographs of plants the firm have manufactured and erected at various gas-works and collieries. The attention of gas managers may be specially directed to the patent tube regenerator furnaces and the labour-saving machinery shown in the catalogue. The photographic reproductions are very effective; while the outline diagrams of mouthpieces, furnace frames and doors, &c., are remarkably clear. The catalogue is printed on art paper, which admirably sets off the illustrations, is strongly bound, and is furnished with an index, preceding which are a number of views of the works.

MR. PATERSON ON LIGHT STANDARDS.

The discussion on Mr. C. C. Paterson's paper, on "Investigations of Light Standards and the Present Condition of the High Voltage Glow Lamp," was resumed at the meeting of the Institution of Electrical Engineers last Thursday night. The portions of the paper in which we are mainly concerned were published in the "JOURNAL" for Jan. 29, p. 279, and comments on the contribution appeared in the same issue p. 266, and last week, p. 333. As on the previous occasion, the greater part of the discussion on Thursday turned upon questions affecting electric glow lamps; and light standards were only incidentally touched upon by various speakers.

The PRESIDENT (Dr. R. T. Glazebrook) announced that they had received a written communication from Mr. A. G. Vernon-Harcourt, which would be published in the "Journal" of the Institution. Mr. Harcourt called attention to one or two points of considerable importance. He referred to the fact that the effect of atmospheric conditions on the candle power of flame standards was not really recent knowledge; it was present in the minds of those who worked at the subject long ago. Mr. Harcourt also alluded to the influence of temperature generally on the flame standard and on electric light standards.

Professor AYRTON resumed the discussion; his remarks being chiefly directed to matters affecting the life and testing of electric lamps. He said Mr. Paterson had given the members a very interesting paper from many points of view, including a great number of apparently carefully conducted experiments. If one dared to criticize tests which had emanated from so revered a laboratory as that at Bushey, one might be inclined to hesitatingly suggest that a little more time might have been given by the author to the consideration of what his predecessors had done on the same subject, and that the reflection which he had been able to bestow upon the results did not equal the exertion and energy he had devoted to carrying out the tests. The speaker then went on to show that to the consumer of electricity, the prolonged life of glow lamps might not be of such importance as the cost and consumption of electrical energy. Proceeding, he said that at the last meeting, Dr. Fleming expressed some astonishment that the comparison of the amyl-acetate lamp and the pentane standard appeared to differ to-day from what it was a few years ago. That was a subject to which a good deal of attention was devoted in the discussion of Dr. Fleming's paper three years ago. He (Professor Ayrton) found he had some tests that he himself made, in a comparison between the amyl-acetate standard and the pentane standard, twelve years ago—in 1895. In this case, however, it was a 1-candle pentane standard; and then the ratio was 0·98 of 1 candle, as given for the 1 candle pentane lamp. He did not know at the time what he pointed out in the discussion of Dr. Fleming's paper—that 1-candle pentane standards differed so much one from another. He obtained in 1903 such standards, and compared them. They were all supposed to give 1-candle; and he got as much as 12·5 per cent. difference between them. One would like to know, in regard to the comparison of the flame standards given by Mr. Paterson, whether the flame standards at the National Physical Laboratory, the Reichsanstalt, the Laboratoire Centrale, and the Laboratoire d'Essais had ever been compared with each other. Either the President or Mr. Paterson would perhaps tell them whether or not the standard at Bushey had been sent from one place to another, or whether the standards had been made in the various countries, according to certain dimensions that had been laid down. In the case of the 1-candle standard, very accurate dimensions were given in Professor Harcourt's patent specification; but he (Professor Ayrton) found that not one of the three 1-candle standards to which he had referred had the dimensions that were detailed in the patent specification; and therefore they could not agree one with the other. Another point to consider was as to whether the quality of the pentane used in the various lamps was defined. The specific gravity, too, doubtless made an important difference. The Board of Trade Photometric Committee of 1895 came to this conclusion: "We therefore recommend that the pentane air flame furnished by a Dibdin argand burner, having the form and dimensions set forth in the appendix, and used in the manner there defined, be accepted as giving the light of 10 standard candles, and that this flame be authorized and prescribed for official use in testing the illuminating power of the gas supplied by the London Gas Companies."* He thought that it would be interesting to compare the Dibdin standard, of which he had one, with the actual official standard; and the result was that, taking the Harcourt as 10, the Dibdin was 10·4. This was a difference of 4 per cent. between what the Board of Trade Committee recommended and what was now stated as being the official standard—viz., the one in the custody of the National Physical Laboratory. When such differences occurred, one could see that tests made by the various kinds of lamps—for instance, the Hefner amyl-acetate lamp and the Harcourt pentane lamp—would give different results. It must be remembered, however, that the Dibdin 10-candle standard, unlike the pentane 10-candle standard had a glass chimney which must introduce inaccuracy. The electricity consumer's position in relation to the change to higher voltages and loss of light from glow lamps was then dealt with by Professor Ayrton.

The PRESIDENT stated that the pentane lamp was the standard of the Metropolitan Gas Referees. The lamp used at the National Physical Laboratory had been repeatedly compared with that standard. At the Reichsanstalt, there were two lamps. One of the two was compared with the standard of the Gas Referees; and the other lamp agreed with it very closely. One of the French standards was also compared with that in possession of the Gas Referees.

Mr. A. P. TROTTER remarked that the author had referred to the Hefner unit as the "official" standard of light in Germany. He (Mr. Trotter) thought it was something more than that. He had not traced it to its legal source; but he believed it to be the legal standard in Germany. The pentane standard which had taken the place of the older parliamentary candle standard was, he understood, not a legal standard. It was an official standard; and it was legal only in the sense that it had been largely adopted officially for testing London gas, so that it was rather limited in its application. The Hefner standard was very nearly adopted at the International Congress at Chicago. In the communication which he proposed to send to the "Journal" of the Institution, he had given reasons why he believed it was not adopted. His own work in photometry had been of a relative character, and not concerned with absolute measurements. But he must say he had used the Hefner lamp, and appreciated it as a thoroughly practical standard. It did not much appeal to electrical people, because it was a flame standard. Flame standards were excellent things for gas, because the corrections cancelled out. He was not, however, sure the gas people knew that there were any. [Laughter.] However, it was no use setting up a glow lamp as a primary standard. There had been an immense amount of work on platinum standards, but it had been given up as hopeless; so that they were forced for the present to use flame standards. As a flame standard, he thought the position that the Hefner lamp had taken in the scientific world entitled it to more respect than had been given to it. It was admitted by the author that all the corrections were better in the case of the Hefner than in the case of the pentane; but the pentane was a larger unit (10 candles), and there was the colour difficulty. But he attached little importance to the colour difficulty. In the laboratory, they must face the colour difficulty as they did other things. The Hefner lamp was a cheap thing, one could almost put it in one's pocket, and it was an easy thing to manipulate. It certainly had great advantages.

Mr. COOPER said their gas friends generally had their eye on the proceedings of the Institution; and in one of the gas papers there had been articles criticizing Mr. Paterson's paper, under such headings as "Electrified Photometry" [*ante*, pp. 266, 333]. Attention was called in these articles to the results obtained in the tests with regard to the effect of carbon dioxide on the pentane standard. Were not the results vitiated somewhat by the variation in oxygen? The speaker called attention to the experiments of Dr. Liebenthal in this connection (*ante*, p. 280); and added that he did not think Mr. Paterson could neglect the point as to oxygen. The results given in Table I. did not appear to be consistent. They got a large variation at first, and little later on. He should also like to know how a fair sample of the atmosphere was taken. There appeared to be two ways in which the atmosphere might affect the pentane standard—one by the air that was mixed with the pentane; and the other by the air round the flame. He did not know whether Mr. Paterson differentiated between the two. The method of ventilation that Mr. Paterson had in his photometer-room also seemed to be very unpleasant; and something more comfortable might, it seemed to him, be arranged.

Mr. LE MESURIER, in the course of some observations on the glow-lamp tests, said their gas friends were making a good many remarks about lamp standards. In one breath they said that pentane standards were perfectly easy to manage, and in another breath criticized the suggestion that the standard lamp was to be kept at Bushey. It was a great thing for the whole electrical industry that there should be one standard, and not dozens all over England.

The PRESIDENT mentioned that he could only allow Mr. Paterson five minutes for his reply; and his answer to the main parts of the discussion would be communicated to the "Journal" of the Institution.

Mr. PATERSON only dealt with one or two points affecting electric lamps, and ignored entirely the question of flame standards. It is to be hoped that he will give an opportunity for the portions of his reply bearing upon flame standards receiving circulation in our columns.

* See "JOURNAL," Vol. LXV., pp. 1010, 1021.

Engineering and Machinery Exhibition.—In the "JOURNAL" for the 15th ult., it was announced that another Engineering and Machinery Exhibition is to be held at Olympia from Sept. 19 to Oct. 19 next. The Hon. Advisory Council, of which Mr. Walter T. Dunn, the Secretary of the Institution of Gas Engineers and of the Junior Institution of Engineers, is a member, held a meeting at the Holborn Restaurant on Monday last week, and unanimously elected Mr. Edgar Worthington, B.Sc., as Chairman—a position he filled in connection with the Council of the exhibition last year. Among other matters considered was the prospectus, which was approved with some minor alterations.

PRESERVATIVE PAINT FOR IRON AND CEMENT.

Dr. Roth's "Inertol."

In the "JOURNAL" for the 15th of May last year, attention was called to the above-named material, which, according to a report made by Herr Kölle, a member of the Frankfort-on-Main Town Council, and the Chief Director of the Water Department, had been successfully employed, in competition with numerous other preparations, for painting the cement lining of an elevated reservoir, and certain portions of the iron mains in the city, to protect them from the action of the water, which, owing to the quantity of free acids in it, had been found to have a very destructive effect. The matter has lately been again brought under notice by Herr Kölle, in an article in the official Government organ of the German building trade, in the course of which he furnishes the following particulars.

The reservoir in question was erected a few years ago at a cost of a million marks. It was constructed in four divisions or chambers, and had a capacity of rather more than 6½ million gallons. The walls had been faced with a view to the application of some protective composition up to the point reached by the water. This work was commenced in the spring of 1902 by painting the walls twice on two divisions of the reservoir up to a height of 13 feet, and the bottom and adjacent parts three times. In order to meet the possibility of the water acquiring a disagreeable taste from the paint, the surfaces were rubbed down with a solution of permanganate of potash; and before being filled with water they were thoroughly rinsed. These measures proved quite adequate. The other two divisions of the reservoir were not touched until the efficiency and durability of the particular composition selected had been proved. After the second chamber had been in use for 200 days, the paint began to show the effects of the water upon it; and it was decided to discontinue the use of the composition employed, and to try experimentally one recommended by Dr. Carl Roth, a chemist residing in the city, who had been engaged to examine the paints used and their effect upon the water. In the spring of 1903, his composition was applied in the fourth division of the reservoir, in conjunction with others; and after a trial extending over 196 days, its superiority was proved, and it was decided to coat the third division with it. This was done in the spring of 1904. In the autumn of that year and in 1905 the divisions of the reservoir were emptied, and inspection of the condition of the various surfaces treated presented some interesting and instructive facts in regard to the utility of the different materials used. These may be epitomized as follows.

During December, 1904, an inspection was made of the first chamber (coated with two of the materials selected), which had been in use for 813 days. Both compositions were found to be completely charred, and they could easily be picked off the wall. But they protected the underlying cement coatings from the attacks of the water. In the second chamber (coated with the same materials), after being in use for 868 days, the paint presented a worse appearance than in the other—parts having already fallen off, and the concrete showing signs of being attacked. The third chamber was coated throughout with Dr. Roth's composition, and after being 206 days in use, on the side walls as well as on the bottom, the cement and the iron parts were found to have kept in perfect condition, and to have retained their full lustre. The fourth chamber, partly coated with Dr. Roth's composition, to which was added some sulphur and alumina, and partly with various other compositions, after being in use for 638 days, showed the surfaces painted with the first-named composition to be the only ones in good condition. On parts of the walls left bare and unprotected by any composition, not only was the cement completely destroyed, but, where the water could penetrate, the concrete behind was eaten away and reduced to powder.

If these experiments had left any doubt as to the value of Dr. Roth's composition, they would have been dispelled by an inspection made in November, 1905, at which the following results were obtained: The first chamber, after 1155 days' use, showed that the paint had been very nearly destroyed and the cement attacked. In the case of the second chamber, which had been in use for 1210 days, the paint had been nearly destroyed, and the cement was seriously attacked; while the concrete showed signs of cracking and partial destruction. In the third chamber, coated with "Inertol," the surface of the walls and the iron parts presented an excellent appearance after being in use for 522 days. The fourth chamber, after 942 days' use, showed equally good results. Upwards of 300 days had elapsed since the previous inspection, and no appreciable change was visible in the surfaces coated with Dr. Roth's composition; while in the other cases both the cement and the concrete had been seriously attacked. The result of the trials was a decision to paint the whole of the reservoir with "Inertol," and also to use it freely for coating the new pipes to be laid in the city, which were found to require some protection.

Herr Kölle concluded by saying that though "Inertol," which has been put upon the market by Herr Paul Lechler, of Stuttgart, does not offer absolutely imperishable protection from the effects of water highly charged with acids, it has proved in his case to be better than any other preservative coating. He had found that it kept in better condition if applied to cement rubbed off with felt discs than to concrete surfaced with a trowel. It could only be applied successfully on perfectly dry surfaces which had been previously warmed.

SUCTION-GAS PLANTS AND GAS-ENGINES.

At a recent meeting of the Leeds Section of the Institution of Electrical Engineers, Mr. HUGH CAMPBELL read a paper on the above subject.

After briefly referring to the development of large gas-engines worked by blast-furnace gas on the Continent, the author summarized some of the reasons for his strong belief in the future of suction-gas plant—viz., its very high economy, extreme simplicity, its cleanliness, and the small amount of space it occupies. He gave a comparative table of costs for steam and gas working, from figures which had been supplied to him by the Engineer and Manager of the Guernsey Electricity Station, Mr. Arthur G. Bird. Both stations were of exactly the same size and capacity, and under the same management; so that they afforded a fair comparative test as to the economy of each system of working. It showed the total works costs in the case of steam to be 0·937d., and in that of gas 0·498d. per unit of electricity generated. He also submitted some figures showing the working cost for an 80 B.H.P. gas-engine set at Broxbourne. In this case, the gas plant was standing idle for 16½ hours out of the 24, and the engine was working only at about half-load. But, even under these conditions, the fuel consumed did not cost more than 0·08d. per H.P. hour. Another example given was the cost of working for one month three gas-engines, each driving 50 kilowatt sets from one gas plant at works at Peterborough, which amounted to 2·9d. for 20 B.H.P. hours. The author said the saving in fuel effected by the substitution of suction gas for town gas varied from 50 per cent. with gas at 1s. 4d. per 1000 cubic feet, 60 per cent. with gas at 1s. 9d., 66 per cent. with gas at 2s., 70 per cent. with gas at 2s. 6d., to 75 per cent. with gas at 3s.

The author next dealt with the design and construction of suction-gas plants, and described his firm's standard plants of 100 and 20 B.H.P. He then considered the various objections raised to the use of these plants. It had been alleged, he said, that, owing to the impurity of the gas, the wear and tear of the engines was great, and the cost of cleaning heavy; that the quantity of lubricating oil used in a suction-gas engine was excessive; that the gas generated was poisonous, and liable to cause harm from its not possessing a pungent smell like ordinary illuminating gas; and that the effluent from the coke scrubber was noxious and caused a nuisance. To all these objections Mr. Campbell replied in detail. He acknowledged that, like all producer gases, suction gas is poisonous and non-odorous; but he said that as the whole plant was working slightly below atmospheric pressure, there was no possibility of an escape of gas. The only time there was an escape from any part of the plant was when it was being started; and then the gas was blown to waste through a properly arranged chimney or waste-pipe.

The final section of the paper dealt with gas-engines. The author pointed out that there are two kinds of engines principally made—viz., the two-cycle, or Clerk; and the four-cycle, or Otto. He said the two-cycle engine could be better named as a two-stroke engine—that was to say, for every two strokes of the engine an ignition took place. The well-known engines of the Körting Company and Herr von Oechelhaeuser were constructed on this principle. Having described engines of the types named, Mr. Campbell said one of the best at present on the market was that constructed by the Nuremberg Company on the Otto cycle. The method of governing gas-engines was next considered, as affecting regulation of speed and economy in working; and the author described successively the quality and quantity governing the mixture and the hit-and-miss system. Lantern slides were shown illustrating the various methods of construction adopted in the different systems, as well as one of the vertical four-cylinder gas-engines which the author's firm have introduced mainly for electric lighting and power stations. Each cylinder works on the Otto cycle, and has its own independent set of inlet and exhaust valves and ignition gear.

In conclusion, Mr. Campbell said that for continuous working with a suction plant it was always necessary that the gas-generator should be in duplicate—*i.e.*, two gas-generators with one set of coke scrubbers. The plant was worked with one generator at a time, and for so long as it could be run without requiring to be clinkered. Before it was shut down for clinkering, the duplicate generator was set going; and for a few minutes both generators were opened to the engine. After this the used generator was closed down for clinkering, and made ready for the next run.

Burst gas-mains recently cut off the supply of natural gas at Cleveland, Ohio. The mains, carrying gas from West Virginia to Cleveland, burst in a swamp about 35 miles south of Cleveland, the explosion destroying about 300 feet of pipe line. The two damaged lines carried 60 million cubic feet of gas per day.

The first American gas-engine patent (No. 3597, May 25, 1844) was granted to Stuart Perry, of Newport, New York, for his two-cycle double-acting air-cooled gas-engine. Perry proposed to enclose the cylinder and its immediate appendages in a case, through which cold air could be blown by means of a rotary fan or other blowing apparatus. Mr. Hugh Dolnar, in an article in the "American Machinist," claims that Perry not only was the original inventor of both air and water cooling of gas-engine cylinders, but also was the first to devise a hot-tube ignition system, which was patented many years later by Daimler.

SCOTTISH JUNIOR GAS ASSOCIATION.

Western District.

A Meeting of the Western District Section of the Association was held in the Technical College, Glasgow, on Saturday evening, and was well attended.

Mr. T. ORR (Motherwell) said that Mr. M'Leod, the President, was ill and unable to be with them; and, in the absence also of Mr. W. Wilson, the Vice-President, he had been asked to take the chair.

LAYING-OUT GAS-WORKS.

Mr. R. A. CAMPBELL (Provan) read a paper on "Laying-Out Gas-Works." In it he dealt with the points of the selection of a site; the surveying of it, the taking of levels, and making sections and cross-sections; the boring of the ground, in order to enable the position of the various buildings to be determined; the making of roadways, railway sidings, and drains; the construction of the gasholder tank; and the building of the retort-house, coal-store, and other structures.

At the Provan Gas-Works, he said, it was necessary to make a roadway. This roadway was 60 feet in width, extending from Cumbernauld Road to the works, a distance of fully half-a-mile. About 1000 feet of it was in cutting; the remainder being embankment. The greatest depth of cutting was 16 ft. 5 in., and that of the embankment 21 feet. It was found that the excavation would considerably exceed the material required for the embankment, so to get over the difficulty a brick-works was erected; and the excess material, which was of boulder clay, was converted into bricks. Hence the Provan works were built of bricks manufactured from clay excavated on the site.

Speaking of the construction of the gasholder tank, he said that after the cope was laid, it was necessary to make marks on the cope, representing the face of the standards; the trainer by this time having been removed. In one case of a tank having a diameter of 283 ft. 7 in., a piano wire, about 150 feet long, was obtained, at one end of which an eye was securely fixed. Through this eye a set-pin was passed. The set-pin was screwed into a plate about 4 inches square, which in turn was made secure in the most convenient manner. The wire was then strained by means of a union screw until a spring-balance fixed at the other end of the wire indicated a pull of 60 lbs. By means of a steel tape, a distance of 142 ft. 2¾ in. was measured off, from the centre of the set-pin along the wire. At this point, a small piece of tin was soldered to the wire, the required point marked distinctly on same, and the measurement checked. The wire, &c., were then taken to the site of the tank, where a small platform was erected, at a convenient height, over the centre-point. The centre-point was next accurately fixed on the platform; and the 4-inch square plate was fastened securely exactly over the centre-point, by being screwed to the platform. The set-pin was then passed through the eye at the end of the wire, and screwed into the plate. The end at which the balance was fixed was next taken over to the cope of the tank, and made secure to a steel bar driven into the ground at the back of the cope. Then, by means of the union screw, the wire was again strained up to 60 lbs., and the point on the piece of tin transferred to the cope, which point represented the face of a standard. The wire was then swung round; and this was repeated until all the necessary points had been fixed. The method proved very successful.

The gasholder tank having been set out, he would advise that the foundations of the retort-house and coal-store be pegged out; but, before proceeding, it would be wise to fix a convenient base-line. This base-line would be of value when setting out the various buildings. They must next fix a convenient point on the base-line from which all measurements must be taken. This point must then be marked on the ground with great care, and might be termed the zero point.

The author concluded with a description of how the position of the buildings was to be fixed from the base-line.

Mr. P. M'DOUGALL (Helensburgh) read a paper on

CARBONIZATION OF COAL FOR THE MANUFACTURE OF GAS.

The author explained that it was not his intention to discuss the advantages claimed for the different types of retort-settings, nor their construction, but simply to point out the operation taking place in the retort-house when coal was carbonized for the manufacture of gas. The method of carbonizing was then described; after which the author treated of the functions of the hydraulic main and the trouble with stopped ascension-pipes. Dealing with the work of the exhauster, he went on to say: One of the most important factors to successful and economical carbonization is the proper regulation of the exhauster, and to maintain as steady a vacuum as possible in the hydraulic main. It is obvious these conditions can be obtained provided the different mains are of ample area for the gas made. It is also necessary to have a complete and efficient arrangement of gas-actuated steam-governors, working upon a frictionless equilibrium valve, fixed on the steam supply-pipe. Sometimes it happens that the gas-main becomes too small for the make of gas, which means that an excessive vacuum has to be maintained at the exhauster inlet, so that the required amount may be obtained on the hydraulic main. In my opinion, the best method of governing the exhauster is to have the vacuum pipe carried direct from the governors to the foul main. By this arrangement, you have the exhauster governed direct from the retort-house. In works where the output of gas is too small to keep a man regulating the vacuum on the exhauster, I think a vacuum indicator would prove itself a good investment, as it would ensure better working in the retort-house.

I might here remark that an instrument of this description is in use at the Helensburgh Gas-Works. The instrument is constructed on the same principle as King's pressure-gauge, having a large dial gauge, with a big movable hand connected to an electric bell. On the dial is fixed a platinum wire to the vacuum required. Should the pull at any time exceed this, the hand strikes the platinum wire, thereby making contact, and causing the bell to ring in the retort-house, thus drawing the attention of the man who is in charge of the exhauster. I might add that the indicator also serves as a pressure-gauge. The gauge in use at Helensburgh was fitted up about eight months ago, and has given satisfaction.

In making tests of coal before ordering, I think gas managers are inclined to attach too much importance to sperm value, owing to the fact that sperm value is at this time of day only a secondary consideration. In my opinion, a better criterion would be (where there do not exist statutory obligations as to illuminating power) the net cost of coal per 1000 cubic feet of gas produced, *minus* residuals saleable. This seems to me to afford a much better and more reliable basis for comparison.

As you are aware, the carbonization of coal for the manufacture of coal gas is practically speaking a chemical process; energy in the form of heat being the agent for bringing about the chemical changes. In order to work retort-settings economically, it is most desirable that a knowledge of what takes place inside the producer should be understood; and to acquire this requires a careful study of thermo-chemistry. Energy, like matter, can neither be created nor destroyed; but when chemical action takes place, it reappears as energy in another form. When a chemical change occurs, the total amount of matter taking part in the change reappears in different form in the products of the change. Chemical compounds can be of two kinds—exothermic and endothermic—the reaction by which they are produced being an exothermic and an endothermic change. In the formation of exothermic compounds, heat is liberated—*e.g.*, $C + O_2 = CO_2$—and when endothermic compounds are formed the heats of formation are expressed by a negative sign, as a certain amount of heat is absorbed in bringing about the change—*e.g.*, $C + S_2 = CS_2$. It is also important to note that the difference in energy under the same conditions of a system, must ultimately be the same, irrespective of the method by which the system is conveyed from one state to another. When carbon and oxygen are burnt together, the carbon unites with the oxygen evolving 14,500 B.Th.U. on complete combustion, irrespective of whether the reaction goes on in one or two phases.

Thus by one phase $C + O_2 = CO_2 + 14{,}500$ B.Th.U.
Or by two phases $C + O = CO + 4{,}000$ B.Th.U.
$CO + O = CO_2 + 10{,}500$.

The heat formed in the producers is the result of chemical reaction between coke, as the substance, uniting with the oxygen. In order to work regenerative settings economically, it is essential that the reactions between carbon and oxygen taking place in separate parts of the setting should be distinct. There are two forms in which the interaction between carbon and oxygen can take place.

(1) $C + O_2 = CO_2 + 14{,}500$ B.Th.U.
(2) $2C + O_2 = 2CO + 8{,}000$ „ = 2 lbs. coke.
(3) $2CO + O_2 = 2CO_2 + 21{,}000$ „ = 2 lbs. coke.

It is necessary in working regenerative settings that reactions (2) and (3) should take place. Now, let us examine briefly the conditions requisite for this. The air passes up the bottom of the producer, and is there acted upon by the carbon of the coke, yielding CO_2 as shown in the first reaction. This again interacts with the carbon, and is reduced to CO as it passes through the mass of hot coke.

In calculating the quantity of heat evolved, we will take as the unit 1 lb. of carbon on complete combustion with oxygen, and base our calculations on this quantity. Now, 1 lb. of carbon and 2·6 lbs. of oxygen yield on complete combustion 14,500 B.Th.U. and 3·6 lbs. of CO_2; or if air be used, 1 lb. of carbon to CO_2 requires 11·85 lbs., yielding 12·85 lbs. of CO_2 and nitrogen. As this 3·6 lbs. of CO_2 passes up through the strata of hot coke, it is decomposed to 2·3 lbs. of CO. Of course, the reaction must be complete. Before this reaction can take place, energy to the extent of 10,500 B.Th.U. is absorbed. If we deduct 10,500 B.Th.U. (heat absorbed in the formation of the above compound) from the total 14,500 B.Th.U., it leaves 4000 B.Th.U. as being the net heat evolved.

I think it is clear that before the reaction $2CO_2 = 2CO + O_2$ can take place, energy in the form of heat is required. In gas-works producers, the method usually employed in practice is to feed the generator with hot coke drawn from the retort set immediately above it. The advantage to be gained by the use of hot coke in the producer is that the temperature is not reduced, as would be the case if "cold" coke were employed. Besides, there is also a certain quantity of sensible heat saved. The carbon of the coke, on combining with the air which has previously been

preheated, or which may not have been preheated, is converted into CO and CO_2 in quantity depending on the temperature of the strata of fuel in the producer. The primary object is to obtain high heats with a minimum amount of fuel. It is possible to consume large quantities of coke without getting the temperature desired; while less quantities of coke, if consumed properly, would give the required temperature.

Suppose the quantity of products of combustion to be doubled, it follows you can only have half the temperature (absolute scale). This brings out a most important point in the working of retort-settings—*i.e.*, if more secondary air is admitted than is required for the complete combustion of the producer gas, the superfluous air acts as a diluent on the products of combustion. It must not be forgotten that the chimney-draught has a direct bearing on the amount of secondary air drawn in. When the producer gas begins to get less, the amount of primary air is also reduced; the results being that the heats are lowered. However, this I believe may be obviated by adopting one of the self-acting regulators for secondary air now on the market. The best and most accurate method of determining whether the products of combustion contain excess of secondary air, is to have a test made with a simple form of apparatus. The chimney-draught also requires careful attention, because, when you increase this, you also increase the liability of external air finding its way into the setting through any cracks there may be.

When chemical reactions take place, the heating effect is either positive or negative. The heat that is produced or absorbed in a chemical change which results in the formation of a particular compound, is termed the heat of formation of that compound. Thus, $C + O_2 = CO_2$. In bringing about this reaction, 14,500 B.Th.U. are evolved; or in the reaction $C + O = CO$, 4000 B.Th.U. are evolved. As I have previously referred to these heats as heats of combustion, it must not be forgotten that, while they are heats of combustion, they have also another definition—they are heats of formation of the above compounds. It is important for us to note that the heats of formation are always the same, irrespective of the conditions under which they are obtained. So we see the quantity of heat produced by the combustion of any substance is the same, no matter whether the combustion takes place rapidly or slowly, provided the same final products are formed. On the other hand, we have seen that the reduction of CO_2 to CO and O can only be brought about at a loss of heat equivalent to 10,500 B Th.U., and the decomposition of CO to C and O takes place with a loss of 4000 B.Th.U. In the realization of the reaction $CO_2 = CO + O = C + O_2$ heat amounting to 14,500 B.Th.U. is required, which amounts to the same as the heat required for formation. In other words, the heat required for the formation and decomposition of carbon dioxide is the same, but the result is the reverse—*i.e.*, on formation, heat is produced; on decomposition, heat is absorbed.

Discussion.

Mr. W. Ewing (Greenock), in opening the discussion, said it was very interesting to know that Mr. Campbell had read a paper from practical experience, which was the basis of all good work. In laying out a gas-works, it was of vast importance, as Mr. Campbell had pointed out, to deal with the important details first; and he had shown that, from the road into the works to the ingress and egress of material, before and after carbonizing, there were many important details to be taken into consideration. He had pointed out that the first essential was a section and cross sections, and a block plan of the works. These, undoubtedly, were the basis of the future gas-works; and the gasholder tank was the first essential, because it took the longest time to construct. The retort-house received next consideration; and then everything else would follow in correct order. Mr. Campbell undoubtedly was an expert in the laying out of gas-works, and he had given the Association a paper of great interest—in fact, one of the most important papers they had had. He had given them some information relative to the troubles in gas-works, such as the choking of ascension-pipes. This trouble was not common in Scotland, but some people had it with them; and as one of these, he could sympathize with others who had recently gone through the mill. In his case, choked ascension-pipes were due to through retorts and erratic seals or high heats. He anticipated this; but as soon as he obtained absolute control of the erratic conditions which existed, the choked ascension-pipes disappeared, but not entirely until the retorts were blocked in the centre. There was always a difficulty, with two ascension-pipes, in getting the gas to pass equally up them both. A cold blast of air on one side would send the larger portion of the gas up the other pipe, with the result that the gas was decomposed, and carbon was deposited. He had had the carbon in all forms. He had a bottle of carbon at home which resembled pills—about the same size and circularly formed. With regard to the other paper, Mr. M'Dougall dealt with the application of a governor to the hydraulic main. This was a very important recent development, inaugurated by that eminent engineer, Mr. Carpenter. He (Mr. Ewing) so favoured it that he had had one fitted to a new section of his works not yet quite completed; and, going a step farther, he had made arrangements for a displacer in the hydraulic main, so that it would be possible, by turning a wheel, to work with or without a seal. Working without a seal, the figures given to him by one of the best authorities, who had done this for many years, showed that an increase of about 500 cubic feet of gas per ton of coal could be obtained. This, of course, was a very important factor in gas production; and, not only so, but there was a decrease in the deposit of carbon inside the retort, which induced a larger yield. The reduction of pressure also added very considerably to the production of gas. In connection with the selection of coal, Mr. M'Dougall had given them some very valuable hints. There were so many different sorts of coal in Scotland, that it was difficult to select the kind necessary for gas manufacture. They found that sometimes the coal they desired was 9d. or 1s. or even 1s. 3d. per ton dearer than another kind; and they were forced, against their will, by way of economizing, to forego the pleasure of using the better coal. Unfortunately, gas committees (who had no knowledge of the production of gas) always liked to buy cheap coal. They were apt to think coal at 10s. per ton was as good as that at 12s.; but they sometimes got 4s. per ton more value out of coal at the latter than at the former price. It was desirable to make very careful tests of coal. He always made these in experimental apparatus. But, beyond this, there should, in all large works, be plant with which they could carbonize on the basis of their general working. They would then have reliable data, under working conditions, which would be available, not for one year, but for all the years in which the coal might last. Reverting to Mr. Campbell's paper, he had omitted to compliment the skill of the late Gas Engineer to the Glasgow Corporation—Mr. Foulis—in laying out the gas-works at Provan. He supposed the cheapness of their construction, and the efficiency of working obtained under the management of Mr. Webster, had shown to everyone that the works were the production of a master mind. There was nothing in the way of elaboration about them. Everything was plain, simple, and efficient; and through the skill of Mr. Webster, under Mr. Alex. Wilson, the new Engineer, everything had been carried out in the most efficient way. But it was sometimes necessary to have ornamental works. If they looked at those which had been completed in Edinburgh, they had there the realized conception of a master—a man of great experience, and with a bold policy. The feeling one had in going into these works was that they had been laid out on scientific lines, and in a style which was worthy of the city of Edinburgh, which anyone with an eye to the architectural or the ornamental would at once see.

Mr. W. Blair (Helensburgh) said the only drawback he saw to the subject of Mr. Campbell's paper was that they did not often have the opportunity of laying out works, or of shifting them, as he remembered had been done several times in Glasgow. With reference to Mr. M'Dougall's paper, he did not know that he could say much more than that the study of gas manufacture certainly required to be very carefully gone about. Gaseous firing itself required this. Unless they grasped both the technical and the chemical part of what they were dealing with, they would be working in the dark. By studying the subject on the lines Mr. M'Dougall had laid down, and testing the waste gases, they would see if they were getting the quantity of heat that was really contained in their settings. With regenerative settings, they were able, with almost ordinary coal, to carbonize 100 lbs. of coal with from 10 to 12 lbs. of coke; or, to take the quantity of coke produced, about 25 per cent. of the whole was all that was required for carbonizing. This was quite a general view of any ordinary regenerative setting.

Mr. D. Vass (Airdrie) said he had recently had considerable alterations in his works; and the same conditions applied in the alteration of old works as in the building of new ones. Among the first things was the question of bores; and he would give the hint that if they were having bores put down, they should be on the spot the whole time. Mr. Campbell appeared to go on the idea of making practically level works. Sometimes the site was on the side of a hill, and it might be advisable, in such a case, to take advantage of the formation of the ground. In his own case he had sulphate-works recently put down, and he could receive the acid on a high-level railway; and on this high ground he had constructed an acid tank, to hold the large quantity of acid they had to take in from time to time from the railway waggons. He could take the acid down to the sulphate-works simply by gravitation. The same applied to the handling of coal. The proposition that gas-works should be at the lowest level of the site had its limits. In Airdrie it was a question whether they should remove the works to a lower site outside the town, or extend them where they were. The question that weighed most with him was that within a radius of half-a-mile they sold three-fourths of their gas. This determined him, to this extent, that the lower level, although it was 100 feet below the present one, was not so suitable as the present level, seeing that in their works they had good railway accommodation. They resolved to extend where they were, although they had to buy up a saw-mill to enable them to do so. If they were putting down new plant, they should do it in some relation to the existing plant—not place it at an angle to the existing plant. He had had experience of this, where two buildings were at an angle, and he had to build two gables where one would have done had it not been for the angle. Mr. M'Dougall had dealt very fully with the subject of carbonizing—in fact, he (Mr. Vass) thought he went a little over it; but the paper was one which would be well worth the study of every member.

Mr. J. Webster (Provan) contributed a little experience he had had with through retorts. He said they had a bench with eight settings of throughs. There were two sections, and a hydraulic main on each side, with tar-towers. It was pretty well on in the winter when they put them up; and they did not get

the second half of the bench quite completed. They started the four ovens which were finished, and had no trouble with them. For the other four they were waiting for the bridge-pipes; but they needed these retorts, so they decided to run them, using only one hydraulic main. Then they received the bridge-pipes for the other side, and put them on; but they never had good results from this section of the bench. The mains had been put up by the same men, and levelled as carefully as possible. The first section gave good results, but not the second. The gas went up the one side for a time, and then it would stick, and go up the other side, where also it would stick; and it was a job to get them clear. He, like Mr. Ewing, had had some experience of through retorts. He had had to make them into two; but when this was done the division walls must be made thoroughly tight, because if gas went from the one to the other there would be trouble with the ascension-pipes. High heats caused stopped pipes. In one retort-house he never had an obstructed pipe; but in another, with a slightly different setting and a little higher heat, they had a good deal of trouble.

Mr. CAMPBELL thanked the speakers for the kind remarks they had made regarding his paper. He said his object was to make it as short as possible, and to give his experience in a brief and simple way. The record of bores he got was a correct one. He was on the ground during the whole time they were being put down. He thought Mr. Vass might have misunderstood him when he spoke about level works. What he said was that various levels of the works ought to be arranged. The Provan works had at least half-a-dozen different levels. Then, regarding the site, what he said was that the lowest would be the best one, provided the ground was suitable. Of course, if the ground were not suitable, the site would not be the best.

Mr. M'DOUGALL thought that, instead of Mr. Ewing asking him questions, he could give them information regarding stopped ascension-pipes. He was at one with Mr. Ewing in his remarks about coal. He had to thank Mr. Blair for his remarks. He was certainly one of the pioneers of gaseous firing, and was well qualified to speak on the subject. The quantity of fuel he was using for firing, per ton of coal carbonized, was worthy of being called attention to. It was most important to note that the charging-door for feeding the hot coke should be so placed that it allowed the coke to flow in uniformly. There were two points he should like to mention regarding Mr. Campbell's paper. First, the author had said nothing as to the quantity of land required for gas-works. He thought he was correct in saying that Mr. Herring, in his articles on gas-works construction, put it at three acres per million cubic feet daily production. Mr. Herring also stated that, when fixing on a site for new works, when land cost more than £200 per acre it was wise to go farther away, and spend more upon the trunk main from the works—distance from the town being no objection. Then Mr. Campbell had not said anything regarding the water supply, which was of great importance. He thought the most common practice was to have a well sunk close to where the steam power was generated, so that, if required, a pulsometer or other type of deep-well pump could be used for raising the water into an elevated tank, which would give sufficient pressure for their requirements. He thanked those who had taken part in the discussion on his paper.

Mr. CAMPBELL, in reply to Mr. M'Dougall, pointed out that he said that the lowest site would be the best, provided the cost of the land was not out of the way. The cost of land in and around Glasgow was very much more than it was perhaps 100 miles to the north. Looked at in this light, it was almost an impossibility to give an opinion as to the cost of land. Regarding the water supply, he purposely omitted this subject from his paper, as the matter was a simple one. No gas-works could ever be regarded as complete without a water supply; and the usual method of getting water was by gravitation—the water being obtained from mains in the district.

This brought the proceedings of a very interesting meeting to a close.

A Self-Starting Gas-Engine.—According to "Engineering Record," a self-starting gas-engine has recently been devised which employs compressed air for starting, but not by the usual method of temporarily using one cylinder as an air-motor. The engine has five cylinders and an arrangement of crank-shaft and valve-mechanism by which one inlet-valve is partly or wholly open at all times. Compressed air is delivered directly to the intake in starting, from which it will enter the open cylinder. The compressed air is admitted through a closed-type carburettor, a check-valve in the intake preventing its escape at this point; and the engine begins to turn over until all five cylinders have thus received a charge of combustible mixture. At this time, the first cylinder has compressed the charge admitted to it, and is then fired in the usual way, starting the engine. In the starting, while each piston is rising on the compression stroke, the exhaust valve of its cylinder is lifted by a cam to relieve the pressure somewhat, and prevent compression to the point of pre-ignition. These cams are operated by a single lever interlocked with the compressed air supply; and they are thrown out of action when the compressed air is shut off, after the engine is started. The compressed air supply is furnished by a pump attached to the valve-shaft, which is automatically controlled to maintain a pressure of 100 lbs. in a storage-tank.

MANCHESTER JUNIOR GAS ASSOCIATION.

A Meeting of the Association was held on Saturday, at which Mr. R. H. GARLICK read the following paper, entitled

SOME OBSERVATIONS ON DISTRIBUTION.

I notice that at least two Junior Associations have had papers read on various phases of distribution, principally dealing with improved methods of lighting by means of high-pressure systems; but the question of the wherewithal, or the mains from the works throughout the district necessary to give these improved results have practically been left alone. I am pleased to learn that more interest is now manifested in the distribution department of the gas industry. Greater thought and care are brought to bear upon the requisite sizes of mains necessary to maintain as far as possible an equalization of both day and night pressures, which will fulfil the requirements of the consumers and prevent the harassing complaints which, in bygone times, were so numerous. These complaints are still in evidence; and increasing watchfulness is the order of the day, as discoveries made daily by our workmen show that, in an area of supply extending over many miles, mains are too small, want enlarging, and probably, as I have found, require cast-iron mains in lieu of ¾-inch, 1-inch, or 1¼-inch wrought-iron pipe supplying whole streets, to the detriment of consumers and loss to manufacturers.

How are we, then, to improve these conditions? The problem possesses many phases. Districts vary; some may be residential, others manufacturing, but all tend to the same nature of complaints—bad pressure, or bad illuminating power, &c. First and foremost comes the question, Are the mains of sufficient diameter to supply the district? This can be answered by a liberal use of the pressure-gauge—an instrument not very complicated, but one which gets one out of many a difficulty. The *modus operandi* should be to locate the particular portion of the district where complaints are most numerous. Observations should then be taken at maximum day and night pressures; the pressures taken (say) at the public lamps, with an occasional house here and there at the inlet of the meter to check the result obtained at the lamps. After the observations are tabulated, compare them with the pressures as shown at the outlet of the governors at the works; and if there is an appreciable difference in the two pressures, the inference is that there is either a stoppage in the mains or that the mains supplying that particular district are too small. The deduction arrived at is, of course, subject to the pressures taken at the lamps being practically equal. Taking, for example, the pressure at the works at 20-10ths, and at the lamps 12-10ths at the commencement and 10½-10ths at the finish of the observation, if the pressure had been (say) 19-10ths at the first lamp, 18-10ths at the next, and then dropped down to 12-10ths at the third lamp, one would conclude there was serious stoppage between the second and third lamps, and locate accordingly.

I have in mind an experience in my own district. From the works there was a 24-inch main for some half-mile, acting as a trunk main; then it was split up into two—a 16-inch and an 18-inch main—one supplying a manufacturing and residential district on a lower level than the works, the other supplying a district at a considerable elevation above the works. Owing to the excessive pull on the 16-inch main in the lower level, with a maximum pressure of 40-10ths at the outlet of the governor at the works, we had great difficulty in getting 10-10ths or 11-10ths pressure at the higher altitude. This demonstrated to us (more so as we lost 8-10ths to 12-10ths pressure from the works to the end of the 24-inch main) that larger mains were needed. These were increased accordingly—24-inch to 36-inch, 18-inch to 30-inch, and so on—and enabled us to reduce our pressure at the works considerably, while maintaining good pressures at the higher altitude. The latter experience will help our members over a difficulty of a similar kind. It may be perhaps appropriate at this point to emphasize the necessity of having your mains well laid. Attention to this factor will save an immense amount of leakage known in the reports as unaccounted-for gas.

Before laying mains, look up your tackle and have everything required. Work systematically; have all your men in the trench till sufficient ground is got out to enable you to start, and then bring back the men required to lay the main. Keep the same set of men at the apparatus, the same yarners and caulkers, &c., as by so doing they get into a regular way of working, and each man knows what he has to do. Have a good sound bed for your pipe to rest upon. Among your gang will probably be found one or two men worth a shilling or two extra per week as "bottomers up" or levellers of the trench bottom. In some cases this work is quite a speciality with them, so adept are the men. Have plenty of room at the joints, so as to insure good caulking; and be sure you have all the air driven out of the main before trying with a light for tightness. If laying an entirely new main, get a circular disc made of a layer of india-rubber fixed between two circular plates of iron or wood (the plates slightly less than the diameter of the main), and firmly bolted—the rubber projecting over the plates (say) ¾-inch. Through the centre of the plates, a long bolt is secured. Between the end of the bolt and the disc, a guide, of the nature of a circular piece of wood, also slightly less than the internal diameter of the main, is likewise secured—the width of guide being according to the size of the disc. The bolt at the guide end has an eye forged on; and through the eye a stout

rope some 12 or 14 feet long is secured. When a pipe has been laid, run with lead, and caulked, the disc is pulled along the pipe to within a foot of the socket, thereby drawing the gas with it, enabling one to test and fill in the pipe as the work proceeds. Another advantage is that one is absolutely sure there is nothing left in the main that would obstruct the flow of gas. A bladder is necessary when commencing and finishing the main. The stopper or disc may be left in from start to finish of a main, if on a straight length. In case of laying a larger main in lieu of a smaller one, it will probably be necessary to connect up every night, owing (as in my own district) to the difficulty of sending the gas round by another route in sufficient quantity to enable the usual pressure to be maintained.

Our usual procedure is to take out the old main up to such a length as will enable us to replace with the larger one within the working hours. When the last pipe for the day has been placed in position, have a short piece of pipe with a socket the same diameter as the old main, about 5 or 6 feet in length, on a spigot end of the old pipe cut off (this cutting off must be in such a position that the piece of old pipe will come in), place the 5 or 6 feet length (the spigot end in the socket of the new main, the socket end on the old main), yarn the socket end, and fill the lead space with cement; the other end, projecting into the new main, is closed up with old bricks, then a layer of clay is put on, and finally a coating of cement, 1 inch thick, on the clay. This will make a joint sufficiently strong to last throughout the night, and one that is easily broken in the morning, after the bladder has been placed in position preparatory to commencing the day's work. It is advisable to have the bladders placed at such intervals as to be easy of access. It is absolutely necessary that the air should be blown from the new-laid section, otherwise complaints of bad gas will probable ensue.

With regard to the connections that may have to be fixed *en route*, let them be of such size and section as will give the least resistance to the passage of the gas. Have them in lengths convenient to handle, and as compact as possible, having due regard to the efficient caulking of the joints. Syphon pots will have to be placed in positions according to the contour of the district—in comparative level districts, a fall of 1 foot in 400 yards. This is a matter that varies according to the locality, also the engineer's opinion. I would strongly recommend the through variety of syphon pot, in lieu of the side pot. The latter with bend under the main, and is liable to get sediment accumulating therein and preventing the condensation from entering the syphon pot, and the pumper may report the pot with (say) 4 inches in when quite possibly the main may be in a fair way of being entirely filled with water. This contingency I have known to occur.

Rules for determining the flow of gas, &c., you are doubtless fully aware of, and I have no need to recapitulate them here. But I would like to draw your attention to a set of diagrams by Mr. Cripps, which, if carefully studied, will give one at a glance everything one needs, and practically in accord with Dr. Pole's formulæ. Excellent experience can be acquired by working out your own estimates, allowing about 10 per cent. for contingencies which may arise. It gives opportunities of coming in contact with the price of pipes, lead, cost of excavation, filling in and reinstating, carting, and other details which are interesting and useful in after-years. Mains should be covered at least 2 ft. 6 in. if placed on the roadway and 2 feet if on the footpath.

After a brief survey of the mains, we come to the services. As great care should be exercised in laying services as in mains. Likewise, in apportioning the sizes thereof, a good plan is to estimate the consumption according to the number of burners or works to be supplied. Having ascertained this, find the meter required. As is well known, every meter has a certain size of inlet and outlet—5-light ¾ inch, 50-light 1½ inch, 150-light 3 inches, and so on. Putting in the same size of service-pipe as the inlet of the meter will about secure an efficient supply. It will be advisable, however, with a view of further extensions, as in the case of works, to put in a size larger. By so doing it will obviate the necessity of relaying the service at some future time.

Strengths of wrought-iron pipe vary according to districts. We use a steam strength, as our strata are very variable; a good portion being made-ground, with a liberal supply of clinkers and ashes. This kind of soil has a very detrimental and oxydizing effect on wrought iron; and unless the pipes are protected, although of steam strength, they soon have to be relaid. Some engineers encase their services in troughs. In our case, where the strata are, as mentioned previously, of clinkers, we encase the pipes in clay or sand. The use of troughs in some portion of our district, subject to colliery subsidence, would hamper us in locating escapes, which are very numerous. We frequently find wrought-iron pipe of all sizes pulled apart, or buckled up by the pressure exerted through the ground slipping. Use bends as far as possible, avoid elbows, let your services fall from the meter to the main, and insist on everything being well screwed up. Great difficulty ensues in having pipes from various makers. Although standard threads are supposed to be universal, a difference is found in some pipes from different makers.

Having also dealt briefly with services, we come to a more interesting point of how to interest the people and popularize the use of gas. How often have we proceeded to this place or that to investigate some complaint of want of pressure, or possibly bad illuminating power. When you arrive, you are told that "the gas is much better to-night," "last night it was wretched, we could not see," &c., &c. You get permission to investigate and take a few pressures, and find that at the inlet and the outlet of the meter there is ample supply, but at the fittings the pressures come down by one-half. You explain the matter to the tenant—there is either a stoppage, or the internal fittings are too small. The consumer replies that the fittings have been in use for some twenty years, and ought to be good enough for a similar period. He forgets the possibility of the accumulation of sediment in the pipes, also the fact that at the time the house was built, there were no rules and regulations as to size of pipe to be placed therein; and, furthermore, he does not understand that the 4 or 6 light chandelier is fed by a piece of ⅛-inch tubing. You have the greatest difficulty in convincing him of the true cause of the bad light, &c. How, then are we to overcome all these prejudices on the part of the consumer? Firstly, in my opinion, we ought to insist (in new property, or property that is being altered) on the internal pipes and fittings being of such a size and bore as will ensure an ample flow of gas throughout the premises needing a supply of gas.

We have in our Gas Department inspectors whose duty it is to inspect all the piping, lead or wrought iron, before being plastered or covered over, and ascertain if it is in accordance with our regulation of sizes of pipes to be used according to the number of lights the house or workshop is about to have. Until these regulations are complied with, no meter is fixed. We also authorize gas-fitters. That is, on their application, they are, after due inquiry as to their capabilities, &c., placed on our list of authorized gas-fitters, to whom we issue a copy of our regulations. This system has the effect of guaranteeing sufficient supply to the burners of the consumers. Secondly, my conviction is that we should offer every facility to the consumers which would be helpful to them in getting the best value both for heating and cooking. Exhibitions by private traders have no doubt done much; but my opinion goes in the direction of lectures in various parts of the district, having an ample supply of the latest burners, &c. Demonstrate, by experiment, the actual results to be obtained, and if you are not at once successful, it leads the consumers, or intending consumers, to a train of thought; and I have such faith that eventually, in the majority of cases, you will ultimately succeed in sending up your consumption to a pitch you never thought possible.

There are many other items that could be considered in connection with distribution—prepayment meters, the benefits they confer upon householders who prefer to pay for gas as they use it, in preference to the quarterly system, obviating thereby the payment of a deposit which is required by some corporations and gas companies. The difficulties we have are with the owners of the houses in which we instal the system. We in Salford find so much lead pipe, and a bracket or pendant with its attachments thereto for india-rubber tube, of which we supply lengths of 6 feet, likewise a griller, fixed at our expense by our own fitters.

The question as to which are best, wet or dry meters? The question of differential rates for lighting, heating, and power? Should we fix cookers free of any rental to any consumer who applies? What we think of the use of suction gas? What would be our attitude should town's gas be required as a stand-by? These and other items can be left to future occasions, or utilized by some members as the basis of a paper or papers. I have also left such questions as unaccounted-for gas, the best method of indoor lighting, subsidences due to collieries, supply of gas to gas-engines, and street lighting, to the future.

In the course of the discussion which followed, Mr. Wellens (Hebden Bridge) said he had listened to the paper with deep interest; and it brought back old memories when he was a member of the Council, along with Mr. Garlick. Mr. Wellens put before the members a plan illustrating the difficulties of an engineer in the laying of mains. Mr. Alsop (Stockport) remarked that he had listened to the paper with a great deal of interest. There were several points which Mr. Garlick had left open, and some which he had not touched upon at all; but this had been done with a purpose. It was for members in their spare time to go through the paper, and find out what these points were. He agreed with the reader in having the work done systematically. Mr. Garlick had gone into the subject in a very capable manner; and there were many favourable tips to be found by anyone who had had no experience in this line. Mr. Braddock asked if the reader had any experience with the patent lead wool. From what he could see, he thought it would be quite applicable for repair jobs; and he wished to know if Mr. Garlick could tell him whether it would be of use for a long length. Mr. Oldfield inquired if it was through being a corporation that they could insist upon the regulations with regard to fixing the meters being carried out.

Several other members having spoken, Mr. Garlick replied on the discussion. He said he had tried lead wool, and found that so much pressure had to be used that the probability was the joint would split. In fact, he could not get it to stand at all. Replying to Mr. Oldfield, the regulations mentioned were embodied in an Act of Parliament; and no meter was fixed until these regulations were complied with.

One member stated that in one of the Manchester works they had just put down a new purifying house; and the whole of the 50 joints had been made with lead wool. There were only two slight flaws. It was not necessary to hammer hard to get a good joint.

Mr. Wellens proposed a vote of thanks, which was seconded by Mr. Alsop; and the meeting then dispersed.

EXPLOSION PHENOMENA OF MIXTURES OF GAS AND AIR.

An issue of the "Mitteilungen über Forschungsarbeiten auf dem Gebiete des Ingenieurwesens" [Reports on Investigations in the Domain of Engineering], published by the Association of German Engineers a short time ago, contains a lengthy article by Dr. F. Häusser, of Kaiserslautern, on the above-named subject. Without reproducing the very voluminous tables accompanying the author's communication, it seems difficult to give a proper summary of his experiments; but in the following abstract translation an attempt has been made to indicate the manner in which his investigations were carried out, and the conclusions at which he has arrived.

The primary objects of the research were to review the accuracy of the formulæ given by Mallard and Le Chatelier for the specific heats of gases at high temperatures and at constant volumes, and to ascertain how these heats are affected by pressure. The experiments were performed on mixtures of air and coal gas, in spite of the variable nature of the latter, at different initial pressures; coal gas being selected as the combustible body because of the great practical importance of the phenomena attending its explosion, and because data are already available respecting the rapidity of its combustion in explosion engines, which data should form interesting matter for comparison with the explosion velocities observed during the investigation.

The explosion vessel employed by Dr. Häusser was a cast-iron cylinder having a capacity of 335 cubic centimetres. A cylindrical shape was preferred to that of a sphere, because in the former a piston-like stirrer could be more effectually used to secure homogeneity in the gaseous mixtures. The handle of the stirrer projected from the end of the cylinder through a stuffing-box; and it was found that the gland could be kept tight against the high final pressures if only the packing were renewed with sufficient frequency. The aperture for the igniting wire was in the side wall of the vessel, about two-thirds of its length from one end; the connection to the indicator being in the same transverse axis. The cock ordinarily used on the indicator could not be maintained air-tight, and it was therefore replaced by a ball or hemispherical valve. The connections for the gas and air inlets, the removal of the final products, &c., were closed with needle-valves, and gave no trouble. The indicator was a Rosenkranz instrument provided with a set of six springs, suitable for pressures up to 25 kilos. per square centimetre [1 kilo. per square centimetre is equal to about 0·968 atmosphere]. The paper drum was revolved by a single-phase electric motor supplied with current from the local generating station; it therefore synchronized with the dynamos within very narrow limits, revolving the paper at 1400 turns per minute. The pressure-gauge attached to the cylinder was calibrated by the Reichsanstalt.

Tests were made of the amount of heat lost during the explosion by absorption into the walls of the cylinder. For this purpose, the short igniting-coil was removed, and a long platinum wire, of known resistance, was introduced into the cylinder through the coil aperture, bent twice upon itself so as to reach almost to the two ends of the vessel, and brought out again through the indicator connection. The wall of the cylinder was drilled almost through at one spot; a thermometer being placed in the hole with its bulb in a bath of mercury, and a second inserted into the interior at the opposite end. An electric current of known wattage was then passed through the wire to render it incandescent; and as soon as the second thermometer remained constant its reading and that of the first thermometer were noted. The coefficient of heat-conductivity of the walls of the cylinder (ϵ)—*i.e.*, the amount of heat in small calories passing to the metal per second per 1° C. of difference in temperature between the interior of the vessel and the walls—was obtained by the following equation:—

$$\epsilon\,(t_2 - t_1) = 0{\cdot}239\ J^2W,$$

where t_2 is the temperature shown by the thermometer in the interior of the cylinder, t_1 the temperature shown by the thermometer in the mercury bath, J the amperage of the current, and W the resistance of the wire in ohms. Two determinations of ϵ under very different conditions gave 0·533 and 0·526 small calorie respectively. Preliminary experiments having shown that the walls of the cylinder gradually suffered corrosion from the explosions, and so altered in heat-conducting power, the cylinder was lined with white enamel before the main investigation was begun. The values for ϵ just given relate to the cylinder after being so enamelled.

As it was not possible to work at higher final pressures than 25 to 26 kilos. per square centimetre, the highest degree of compression to which the original gaseous mixtures could be brought was 5·11 kilos. absolute, as measured before the valve leading to the indicator was opened. This opening caused a small reduction in the compression, which was, of course, allowed for. Hence, five series of experiments were performed, in which the original compression was 1·01, 1·90, 2·80, 3·55, and 4·40 kilos. per square centimetre respectively. In each series, the proportion of coal gas in the gaseous mixture varied from about 7 to about 16 per cent. by volume.

The coal gas contained on an average 3·6 per cent. of carbon dioxide, 4·7 per cent. of heavy hydrocarbons, 0·7 per cent. of oxygen, 8·3 per cent. of carbon monoxide, 50·2 per cent. of hydrogen, 29·6 per cent. of methane, and 2·9 per cent. of nitrogen by volume. Its specific gravity at 0° C. and 760 mm. was 0·5641, and the specific gravity of the heavy hydrocarbons in it was 1·975. Its gross calorific value, as determined in a Junkers calorimeter, was 668 B.Th.U. per cubic foot at 0° C. and 760 mm., or, allowing for contraction, 618 at constant pressure. Its net calorific value at constant volume was hence calculated to be 600 B.Th.U. per cubic foot at 0° C. and 760 mm. By calculation from the average chemical composition of the gas, its calorific value appeared to be 576 B.Th.U.; the difference of 4·2 per cent. being due to the errors involved in deducing calorific value from chemical analysis in which all the "heavy hydrocarbons" are estimated together. Determinations of the proportion of carbon dioxide in the explosion products showed that each volume of the total heavy hydrocarbons in the original coal gas required 3·3 volumes of oxygen for their complete combustion, yielding 2·2 volumes of carbon dioxide and 3 volumes of water vapour. The compressed air used in the experiments had the composition of normal air. An amount of 0·2 per cent. by volume of carbon dioxide in it (derived from traces of this gas clinging to the storage cylinder from a previous charge) could be fairly ignored. Estimations of the proportion of nitrogen in the gaseous mixtures fired and in the several combustion products, gave concordant results—indicating that the combustion of the gas in mixtures containing up to 14 or 15 per cent. by volume of it was perfect within the limits of experimental exactitude.

Some Results Obtained.

The five series of explosions at the five different initial pressures already mentioned showed that gaseous mixtures containing 15 to 16 per cent. by volume of coal gas burnt about ten times as rapidly as mixtures containing only 8 or 9 per cent. The effect of the initial pressure upon the velocity of the explosion appeared to be small; but perhaps an increase in the compression slightly hastened the explosion of the richer gas mixtures, and slightly slowed the explosion of the poorer ones. Defining the duration of the explosion as the interval in seconds between the moment of ignition and the moment when the indicator showed the maximum pressure, some idea of the author's figures may be conveyed by those given below.

Initial Compression.	Percentage of Coal Gas in Mixture.		
	8–9	11–12	15–16
1·01 ..	0·236 ..	0·074 ..	0·040
1·90 ..	0·329 ..	0·081 ..	0·025
2·80 ..	0·421 ..	0·073 ..	0·028
3·55 ..	0·353 ..	0·087 ..	0·023
4·40 ..	0·304 ..	0·090 ..	—

These results do not agree well with others that have already been placed on record. For example, some five years ago, Meyer carried out experiments in an engine with a coal gas very similar in composition and calorific power to the material used by Dr. Häusser. Meyer's mixtures contained from 10·1 to 11·8 per cent. by volume of gas; and his explosion velocities ranged from 0·025 to 0·035 second, whereas conformity with Dr. Häusser's results would demand velocities of from 0·085 to 0·125 second. Of course, conditions in an engine cylinder are not strictly analogous to those obtaining in an experimental explosion vessel. The engine cylinder is warm, heats the charge, and hastens the explosion. On the other hand, the charge in an engine is contaminated with the combustion products, which should retard combustion. On the whole, it would seem the moment of maximum pressure shown by an indicator on a gas-engine cylinder does not signify the end of the combustion, which must continue after that moment as the piston travels onwards. This should be true even if the gaseous mixture supplied to the engine is homogeneous. A more rapid combustion is to be obtained by the employment of richer mixtures, and by thorough commingling of the gas and air.

The mean specific heats at constant volume of the combustion products were first calculated from the thermo-chemical data collected during the research on the assumption that no dissociation occurred. Five different calculations were carried out for gaseous mixtures containing from 11 to 15 per cent. by volume respectively of coal gas; three different initial pressures being employed. The averaged results were: For an initial pressure of 1·90 kilos. per square centimetre absolute, 0·420; for one of 2·80 kilos. absolute, 0·3684; for one of 3·55 kilos. absolute, 0·3536. Two similar calculations made for an initial pressure of 4·40 kilos. gave a specific heat of 0·3415. Application of Mallard and Le Chatelier's formulæ to the five different combustion products obtained at an initial pressure of 3·55 kilos. per square centimetre absolute led to an average mean specific heat at constant volume of 0·258. It will be seen that the author's experimental results are much lower than those given by the Mallard and Le Chatelier formulæ, but the former tend to approach the latter as the initial pressure increases. The differences between the results also diminish as the temperatures attained during explosion rise. The Mallard and Le Chatelier formulæ were obtained from experiments at temperatures exceeding 1900° C.—a point which was seldom reached by Dr. Häusser. It is also quite probable that the correction employed by him for the loss of heat during explosion, deduced in the manner previously described, was too small; for the radiating power of a mass of gas

completely filling the cylinder at a medium temperature of from 500° to 900° C., is, no doubt, greater than that of a thin platinum wire at a bright red heat.

The next point studied by Dr. Häusser was the influence exerted upon the explosions of any endothermic reactions taking place simultaneously. It was found that the oxidation of the nitrogen was too small in extent to exerf any appreciable effect upon the heat liberated, or upon the mean specific heat of the combustion products. Only when the initial pressure reached 3·55 kilos. per square centimetre did the oxidation of nitrogen become as noticeable in its effects as the loss of heat by passage into the substance of the experimental cylinder. Similarly, the decomposition of the carbon dioxide into carbon monoxide was negligible in a gaseous mixture containing some 15 per cent. by volume of coal gas, and would be of no importance even at temperatures somewhat exceeding those observed by the author. On the contrary, the effect produced by the dissociation of water vapour was found to be serious at temperatures exceeding 2000° C., even when such poor mixtures were exploded as it is customary to use in internal combustion engines.

As the dissociation constant of water vapour has not yet been directly measured, the author calculated it from Bose's value for the electromotive force of a gas cell at 25° C.—*i.e.*, 1·139 volts—using the method suggested some time ago by Preuner and the formula given by Van 't Hoff for connecting the constant with temperature. In this manner, Dr. Häusser obtained the following formula for the dissociation of water vapour :—

$$\log K + \frac{24{,}678}{T} - 3{\cdot}3 \log T + 0{\cdot}000654\, T = 0{\cdot}749$$

$$\text{or} \qquad K = \frac{p_5^2\,(p_2 + 0{\cdot}5\,p_5)}{(p_4 - p_5)^2}$$

where p_2 is the partial pressure of the oxygen, after allowing for the formation of nitric oxide; p_4, the partial pressure of the water vapour in the combustion products if no dissociation occurred; and p_5, the partial pressure of the hydrogen after dissociation. Hence it can be shown that, starting with an initial compression of 3·55 kilos. per square centimetre absolute, the formation of free hydrogen may absorb 7·8 per cent. of the total heat liberated at a temperature of 2030° C., and 13·1 per cent. of the total at 2140° C. With allowance for this amount of dissociation, the mean specific heats of the combustion products at constant volume up to the two temperatures just mentioned are represented to be 0·322 and 0·306 respectively; Mallard and Le Chatelier's formula giving 0·267 and 0·279.

The general conclusions drawn by Dr. Häusser from his investigations are summed up by him as follows.

(1) The duration of the explosion of a mixture of coal gas and air may be said to be independent of the pressure at which it originally exists.

(2) From a comparison of the periods of time occupied by the experimental explosions with those which proceed in an engine cylinder, it would appear that combustion in the cylinder is not complete at the moment when the indicator shows the maximum pressure, even if the gaseous mixture is thoroughly homogeneous; nor, if the proportion of gas present exceeds a certain amount, is it complete at the moment when the piston begins its forward stroke. In this respect the use of more rapidly-burning mixtures would be preferable.

(3) In the explosive combustion of mixtures of coal gas and air, the dissociation of water vapour produces a distinct effect upon the quantity of heat liberated at all temperatures above 1750° C., but the decomposition of carbon dioxide and the formation of nitric oxide are negligible factors.

(4) The increase in pressure accompanying explosion—*i.e.*, the ratio of the initial to the final pressure—is not always the same, but increases with increasing initial pressure.

(5) The experiments demonstrate the accuracy of the Mallard and Le Chatelier formulæ for the specific heats of the combustion products obtained from mixtures of coal gas and air, provided the initial pressure is some 3·5 kilogrammes per square centimetre or upwards, and the temperature attained is above 1800° C. When the temperature or the pressure is lower, the final pressures calculated from the formulæ are higher than those which actually arise.

(6) An application of the simple gas laws (Boyle and Gay-Lussac) to the explosive combustion of mixtures of coal gas and air, with the object of calculating the temperature of explosion from the rise in pressure, shows the specific heats of the combustion products to be a function of the pressure, decreasing as the pressure increases.

A Useful Carbonizing Book.—We have received from Messrs. James Milne and Son, Limited, one of their carbonizing books. It consists of twelve foolscap pages ruled in columns for entering the state of the meter index, the quantity of gas made, in stock, and sent out, the coal carbonized, the gas made per ton, and the number of retorts, with space for remarks as to the coal used per man and per charge, the gas made per mouthpiece, and the cost per 1000 cubic feet. At the foot of each page there is space for a summary and for entering the previous year's figures. The back of each sheet is utilized for illustrating the firm's specialities; and they are bound together in a stout wrapper. The book will be found very useful by managers for recording their working results.

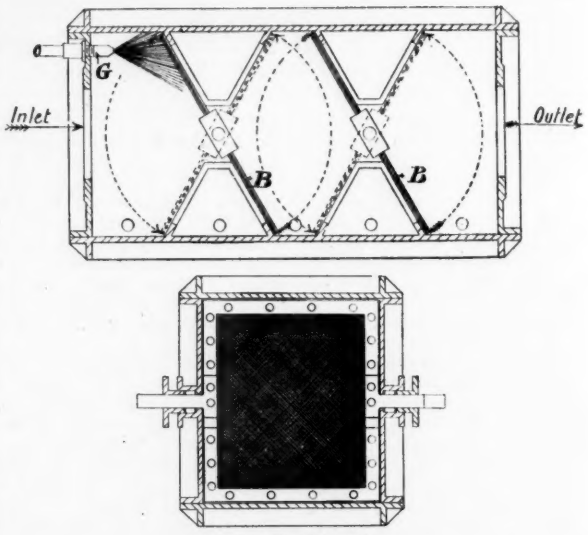
REGISTER OF PATENTS.

Extracting Tar from Gases.

BLAKELEY, W., of Thornhill, Dewsbury.

No 1257; Jan. 17, 1906.

The tar contained in gases obtained from coal, coke, wood, and other substances is, says the patentee, found to be "very thin," and "difficult to remove with the ordinary washing and cleaning apparatus." Screens used for the purpose quickly get choked up unless the gas is passed alternately through each side.



Blakeley's Tar-Extractor.

The apparatus proposed for the purpose consists of two or more screens B, of wire or other mesh, provided with axles or pivots in the centre, by means of which they can be turned. The screens are in a wrought-iron frame; and they may be turned from the position shown in full lines to that shown in dotted lines (the gas always passing in the same direction through the apparatus). The incoming gas comes into contact with the opposite sides of the screen; and if turned at short intervals backwards and forwards, the gas, of course, passes alternately through each side.

A continual supply of steam at G can, if desired, be arranged to play upon the screens—thus keeping them moist, and also assisting the deposit of the tar.

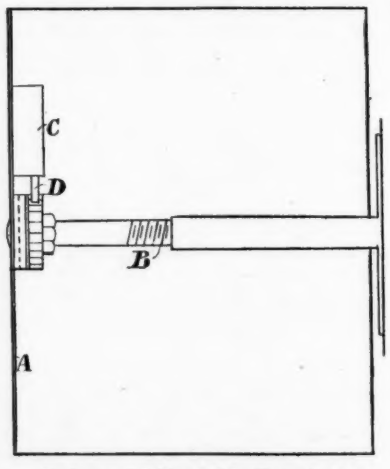
The patentee says he is aware that it has been proposed to use reversible plane screens for separating dust and fibre in apparatus for preparing cotton and other textile fibre; but his invention is distinct from these, notably so in the fact that the direction of the flow of gas is not changed or interrupted.

Device for Preventing Robberies from Automatic Gas-Meters.

PARKER, S., of Bow, and JEFFREYS, C., of Stepney.

No. 2021; Jan. 26, 1906.

This device consists (as shown) of a box or drawer, arranged to fit to existing automatic meters, so as to receive coins passed through the slot. The front of the box is provided with a stout metal plate A, to which is firmly attached a revolvable screw B, which engages and



Parker and Jeffreys' Coin-Meter Lock.

screws into a pipe or cylinder fixed to the hind portion of a case that the box fits into. In this way, the box is firmly held to the case, and acts in combination with the device in order to lock it.

Barker's cylinder lock C (Patent No. 26,003 of 1902) is fixed to the

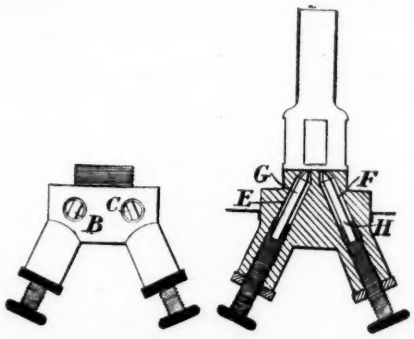
front metal plate; the bolt D being toothed to engage and disengage a cog-wheel attached to the revolvable screw whereby the device is locked or unlocked at the will of the collector.

Gas-Burner Nipple.

ROESSLER, A. C, and AIR-LIGHT COMPANY, LIMITED.

No. 6792; March 21, 1906.

The object of this invention is to provide means for adjusting the proportions of air and gas passing to a burner without the necessity of opening the lamp.



Roessler's Adjustable Gas-Burner Nipple.

Gas and air are led into a cylindrical body through separate passages B C. These passages lead to two inclined passages E F, having their exits (at the burner mixing-tube) comparatively close together. A taper end is provided on each of the inclined passages, and these ends engage with the pointed screws G H, which pass out through the body of the nipple. The adjusting screws are placed externally to the lamp casing; and the quantities of gas and air passing to the burner are regulated by adjusting the screws.

The object of inclining the passages towards each other at their outlet to the mixing-tube is said to be "to obtain a better mixture of gas and air by making the two streams of fluid impinge on one another and form one stream of mixed gas and air which enters the burner."

Strengthening Incandescent Mantles.

HOSEASON, J. H., of Manchester.

No. 9307; April 20, 1906.

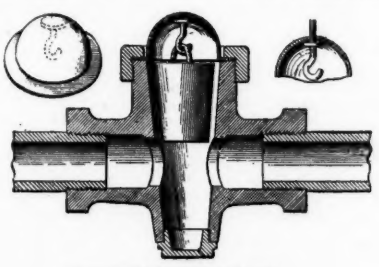
The patentee acknowledges knowing that incandescent mantles have previously been strengthened by folding over their lower edges and also by enveloping them with a cup-shaped net, cage, or basket of platinum or other wire or of asbestos cords, and that asbestos cords have been employed to strengthen suspended and inverted incandescent mantles; also that in an automatic gas-igniter a piece of platinum wire has been employed in combination with an igniting bulb—the wire being hooked over the upper end of the mantle, not over the usual suspension cord or loop, and then carried to the bottom of the mantle and turned under and caused to engage with the lower end of the mantle. Various other arrangements of wire have been likewise used to strengthen the mantles; and so he makes no claim for any such arrangements, but only for special applications of wire: 1. In an inverted mantle, a piece of fine wire bent under the mantle and preferably passed through its sides and having its ends secured to the fireproof ring, or its equivalent, at the top of the mantle. 2. In a suspended mantle a piece of fine wire connected to the cord at the top of the mantle and carried to the bottom and then carried round the mantle itself.

Shutting Off the Supply of Gas in Case of Fire.

JENCZEWSKY, A. W., of Chicago, U.S.A.

No. 13,671; June 14, 1906.

These automatic self-closing safety valves (for cutting off the gas in case a fire occurs where the pipe is laid) consist of fusible metal plugs which, on melting, allow the valves to close on to their seats.



Jenczewsky's Gas Cut-Off.

As shown, the valve-chamber is provided with a dome-shaped thin sheet-metal cap which projects from the body of the valve, and is provided at its top interior portion with a thin layer of fusible metal. The whole of the upper service of the disc, being in contact with the thin metal, is readily melted when any external rise of temperature takes place; and if a valve of the straightway type is employed, the closing of the valve is uninfluenced by the pressure of the gas, whereas, in hitherto proposed devices of this nature, the valve has been of the type that is closed either against or with the pressure. A further feature of the invention is the provision of a pin upon the valve-supporting means for forcibly releasing the valve—the pin projecting through a hole in the dome-shaped cap.

APPLICATIONS FOR LETTERS PATENT.

2090.—LESSING, R, "Extracting cyanogen." Jan. 28.
2158.—HIBBERD, C. E., "Coin-freed meters." Jan. 28.
2201.—CLINCH-JONES, F. J, "Making gas." Jan. 29.
2252.—PETERSON, P. E., "Gas-burners." Jan. 29.
2258.—STILL, W. M., and ADAMSON, A. G., "Incandescent gas-lamps." Jan. 29.
2285,—HUGHES, W. T., "Water-meters." Jan. 29.
2303.—EHMANN, C. P., "Atmospheric burners." Jan. 30.
2330.—POTTER, W. G., "Mantles." Jan. 30.
2408.—DAVIS, E., and YATES, W., "Burner and mantle holder" Jan. 31.
2426.—KEABLE, A. H, and DUCKHAM, A. M'D, "Conveyor-chains." Jan. 31.
2490.—TANCZER, E., "Incandescent burner." Jan. 31.
2500.—GEBR. KÖRTING AKT.-GES., "Water-jet condensers." Jan. 31.
2510.—PRICE, C. W., "Incandescent lamps." Jan. 31.
2527—BURY, J., "Incandescent burners." Feb. 1.
2534.—GROSSMANN, J., "Treatment of ammonia liquors before and after distillation." Feb. 1.
2538.—SCOTT, W. B., "Supporting gas-lamps." Feb 1.
2563—WIGLEY, P., and ARCULUS, G. N. & E. A., and WARRY, J., "Inverted incandescent gas-lamps." Feb. 1.
2617.—STILL, W. M., and ADAMSON, A. G., "Gas-lamps." Feb. 1.
2663.—GLOVER, S., and WEST, J., "Regenerator setting for vertical retorts." Feb. 2.
2676.—FELTEN and GUILLEAUME-LAHMEYERWERKE ACT.-GES., "Manufacture of water gas." Feb. 2.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by our Correspondents.*]

A Difference in Opinion.

SIR,—I have carefully read your article in this week's "JOURNAL," on "The Beneficiaries of Economy in Municipal Gas Production." You therein praise Widnes for supplying gas to its consumers at a price which practically represents its cost, and unfavourably compare therewith Manchester which applies about £1000 a week derived from gas profits in reduction of rates.

I have no interest in either of these undertakings or localities; but, as a shareholder in a gas company, I am heavily hit by the action of a municipality in another place, who supply electricity at cost price. This makes me look at the matter from another point of view.

By referring to figures for 1905 (which are the latest I have), I find Manchester had invested in its gas undertaking about one and a quarter million pounds. This capital was provided not only by gas consumers, but by the ratepayers generally. It seems to me that the ratepayers who provide the capital of the undertaking are entitled to have a reasonable rate of interest paid to them. The sum of £1000 you mention as the amount which the Manchester gas undertaking pays weekly towards the rates represents about 4 per cent. per annum on the capital belonging to the ratepayers. The gas consumers, therefore, have their gas produced for them under favourable circumstances as regards the profit chargeable in respect of interest on capital; and I am unable to see why the ratepayers should lend the capital free of interest so that the gas consumers should be able to get their gas more cheaply. If there is a loss on any municipal gas or other undertaking, the ratepayers have to bear it.

In the case of the municipality of which I have complained, the principle you praise Widnes for adopting, is applied to electricity, with most unfair results to our gas undertaking.

Wealdstone, Middlesex, Feb. 6, 1907. J. E. LILLEY.

[Underlying our correspondent's disagreement with the position that has been consistently taken up in the "JOURNAL" as to the proper treatment of the revenues of municipal trading undertakings, is the old fallacy that capital is provided by the ratepayers. It is not. The ratepayers are not called upon to put their hands into their pockets for a penny piece for capital. The money used for capital purposes is borrowed money; and the people who lend it are paid their interest and have the principal repaid (assuming the undertaking to be a prosperous one) out of the profits of the concern—and those profits come entirely out of the pockets of the consumers. Why should the consumers pay interest to those who lend the money, and also to others who do not lend money? That is not what is done in ordinary business life, nor by the gas company in which Mr. Lilley is a shareholder; but still our correspondent would have municipal consumers pay interest twice over. If the ratepayers in proportion to their rateable standing were called upon to personally provide from their own pockets the capital invested in a concern, then the position would be altogether reversed. The ratepayers have one responsibility. Should any deficiencies arise, they are called upon to make them good. That is the beginning and the end of their responsibility; and the recoupment of any out-of-pocket expenses under that responsibility ought, in equity, to discharge the obligation of the undertaking to the ratepayers. They have as ratepayers done nothing whatever beyond that to entitle them to reward. But let us keep to the Manchester gas undertaking for

illustration. What do consumers do there? They provide interest on the capital employed, the money required for sinking fund, the money needed for maintenance and renewals, and they pay the undertaking's share of the city rates; and after doing all this (without asking the ratepayers to contribute a penny piece), our correspondent holds that they should pay something in excess for the benefit of those ratepayers who have contributed nothing whatever to the success or to the financing of the undertaking. To make gas consumers contribute something to the rates, after providing for interest and sinking fund upon the capital involved in the business, is indirect and unfair taxation upon one section of the community. A company administered undertaking is in a more fortunate position than a municipally administered one, in that it has not to provide a sinking fund; and yet Mr. Lilley would impose the additional liability of having to provide something for the ratepayers who have done absolutely nothing towards earning or deserving it. The Manchester electricity undertaking does not contribute anything to the rates; and those ratepayers who patronize the electricity undertaking harm the gas undertaking by depriving it of business. Yet there are among the electricity consumers some of the largest ratepayers who derive the greatest amount of benefit from the distribution of the profits of the gas undertaking from which they have withdrawn their support. Again we desire to know, where is the justice of this? If the electricity undertaking referred to by Mr. Lilley meets all its financial obligations from its own profits, then it is doing, by the repayment of principal, one thing more than the local gas company. Where, then, is the gas company injured? They can only be injured by irregularities in management—such as supplying one class of electricity consumers below a paying price, and causing another class to bear an extra part of the financial burdens of the undertaking. Where a municipal electricity undertaking has to fall back upon the rates for support, and take a large sum from the ratepayers for public lighting, that is the result of the concern not being run on business principles. We are opposed entirely to municipalities undertaking work that can be done equally as well, or better, by private enterprise; but we are also opposed to the gas consumers as a section of the ratepayers being bled for the benefit of other ratepayers who have not contributed either to the repayment of principal, the furnishing of the interest on the capital employed, and the placing of the undertaking on a sound financial basis. Such bleeding is really unequal taxation. For these reasons, we cannot agree with our correspondent.—ED. J.G.L.]

Opening of the Bristol Gas Company's New Offices.

In the "JOURNAL" for Aug. 30, 1904 (p. 600), we gave a view of the new offices then in course of erection for the Bristol Gas Company, of which a few particulars appeared in the preceding issue. The building was ready for occupation at the close of the past month, the staff moved into it on the 2nd inst., and it was opened the following Monday without ceremony, for the use of the public. The situation of the new offices facilitates the transaction of financial business between the Company and the consumers; while in the fine showrooms the latter are afforded an opportunity of inspecting the latest and most improved designs of pendants, brackets, stoves, and other gas appliances. Attention is attracted by the brilliant lighting of the building, both inside and outside. Along the exterior balustrade are four incandescent lamps of 600-candle power; in the entrance lobby is a lamp of 300-candle power; and the central hall is lighted by numerous pendant incandescent mantle lights. In the spacious general offices are eight pendants, each having four lights; and there are ten upright lights, held by brackets, affixed to the walls. These groups of burners are automatically lighted and extinguished. Though the removal was only made on the previous Saturday afternoon, the new offices were in excellent order when they were opened.

A Large Customer for the Derby Gas Company.

Readers of the "JOURNAL" may probably remember that the Midland Railway Company have at Derby their own gas-works, of which Mr. Henry Fowler has charge. We learn that the Company have decided to discontinue the manufacture of gas, and take what they require from the Gas Company. The "Derby Daily Telegraph," in referring to the matter, says the Company are not making an altogether new departure, as in their early days, and for a number of years, they were in the habit of looking to the Gas Company to supply all their needs at the Derby Station, and only commenced the manufacture of gas themselves some 25 years ago. The same paper says the relations between the two Companies have always been of a cordial character; and in the friendly arrangements made between them in past years, the Railway Company gave up to the Gas Company the land on which the Litchurch works now stand. Moreover, part of the plant that has been used by the Railway Company in the manufacture of their gas was originally the property of the Gas Company. In the new arrangements about to be entered into there will not, it seems, be any great hardship involved by the displacement of labour. The change will be made very gradually, and, as a matter of course, the addition of 175 million cubic feet to the present output of upwards of 600 millions will necessitate the employment by the Gas Company of more men, who will naturally be taken over from the Midland. It is believed that no great capital outlay will be necessary on the part of the Gas Company to meet this largely increased demand on their resources.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Tuesday, Feb. 5.

(*Before Mr. Justice* PARKER.)

In re Kent County Gaslight and Coke Company, Limited.

The petition of J. R. Carmona and others for a compulsory winding-up order in connection with this Company (see *ante*, p. 352) came before his Lordship again to-day.

Mr. VANNECK said the petition stood over from the previous week, and the petitioners were prepared to assent to it being postponed for another fortnight if his Lordship would allow it.

His LORDSHIP inquired as to the long list of people who had given notice of supporting the petition.

Mr. EUSTACE SMITH said he appeared for them all, as well as for the petitioners.

His LORDSHIP said he thought the petition ought to be ready for hearing in a fortnight, as it ought not to be kept hanging over the Company too long. The uncertainty was disadvantageous to them.

Mr. SMITH said his friend's clients were appealing from a decision of Mr. Justice Joyce, on which he (Mr. Smith) relied as part of his case.

His LORDSHIP inquired if the decision referred to was the one under which the names of certain people had been taken off the register, on the ground of misrepresentation.

Mr. SMITH said it was. The Company wanted the petition to stand over pending the appeal; but he could not agree to that.

Mr. VANNECK said this was what he should ask when the petition came on, and after they had gone into the facts.

Mr. SMITH said his clients did not think the appeal was *bonâ fide*.

His LORDSHIP said the matter might stand over for another fortnight, and then he would see what was to be done.

HIGH COURT OF JUSTICE—REFEREE'S COURT.

(*Before Mr.* MUIR MACKENZIE.)

Kellett v. Stockport Corporation.

As briefly reported in our issue of Dec. 25 (p. 899), this important action for damages for breach of contract in connection with the construction of water-works for the defendant Corporation was adjourned until the 10th ult.; but, by subsequent arrangement, the renewed hearing began on Jan. 14 and continued until the 29th. The reference has thus lasted over twenty-two days, and the reserved judgment of the learned Official Referee was delivered on the 4th inst.

As before, Mr. A. M. L. LANGDON, K.C., Mr. NORMAN CRAIG, and Mr. J. A. SPEDDING (instructed by Mr. Robert Rodgers) appeared for the plaintiff; Mr. W. PICKFORD, K.C., Mr. E. SUTTON, and Mr. C. M. BAILHACHE (instructed by Messrs. Rawle, Johnstone, and Co., agents for the Town Clerk of Stockport) represented the defendants.

Mr. *Albert Johnson*, the Chairman of the Stockport Corporation Water-Works Committee, was the first witness called for the defendants. Examined by Mr. Sutton, he said Mr. Mansergh's scheme was to give Stockport water at 5½d. per 1000 gallons in substitution of Manchester water at 8d. Mr. Hill and Mr. Hawksley were subsequently consulted. The Corporation came to the conclusion that, on these compressible shales, they could not take the responsibility of building a masonry dam.

In cross-examination by Mr. LANGDON as to various letters and conversations between witness, the Town Clerk, and Mr. Mansergh, witness said the Committee were entirely in the hands of the Engineer, in whom they had great confidence. The receipt of Messrs. Deacon and Unwin's reports (forwarded by Mr. Kellett) induced the Corporation to suspend the progress of the works. He could not explain how the Corporation, through the Town Clerk, took up an attitude towards their Contractor that was the reverse of the truth.

In answer to the OFFICIAL REFEREE, witness said the Town Clerk must be responsible for the correspondence. Mr. Kellett did not want to vacate the contract; he wanted to go on. They did not want Mr. Kellett to be able to say they had delayed him. They started to spend £248,000, and could not go up to £1,000,000. It would strangle the town. Financial considerations had to be seriously weighed. The Contractor was allowed to go on with the tongue-trench, because Mr. Hill advised that it would be necessary in any case.

In re-examination by Mr. SUTTON, witness said the Water Committee had no desire to mislead Mr. Kellett, or to impose upon him in any way. The Committee never interfered until they were satisfied that the masonry dam could not safely be constructed.

Mr. *G. H. Hill*, M.Inst.C.E., examined by Mr. BAILHACHE, said he had constructed 29 reservoirs in the valleys near the River Kinder. The reservoirs now in course of construction in the Derwent Valley were formed by masonry dams. His opinion was that a masonry dam at Kinder was unsafe, because there were both soft and hard beds of shale. He believed that the fault at hole No. 4 had never been bottomed. The danger was unequal settlement upon a compressible foundation. As to the Contractor's quarries, they were not favourable for getting large stone.

In cross-examination by Mr. CRAIG, witness thought that the alterations to the original contract were such that reference to the Committee for consent was necessary. On his visits, there was not much of the foundations to be seen, for pumping had been stopped. He entirely condemned the site as unsafe for a masonry dam. He denied having a prejudice in favour of earthen dams. He never paid any regard to

waterspouts, as there had not been any for 60 years. He was not aware of any masonry dam in England where the factor of safety had proved insufficient. He had made no experiments, nor sunk any trial holes, to ascertain the stress in a dam as designed. He knew that if an earthen dam were constructed, instead of a masonry one, the contract would be broken. The question of cost was a prominent one.

After re-examination by Mr. SUTTON,

Mr. *E. P. Hill*, son of the previous witness, was called and examined by Mr. PICKFORD. The great trouble was the different degrees of compressibility. His opinion was that the site was not a suitable one for a masonry dam.

Sir *Alexander R. Binnie*, examined by Mr. SUTTON, said that, in his opinion, the site was totally unsuited for a masonry dam, owing to the subsoil being composed of materials of various degrees of compressibility.

In cross-examination, witness said he had never built a masonry dam.

Mr. *J. W. Madeley*, M.Inst.C.E., examined by Mr. BAILHACHE, said he was Resident Engineer of the Kinder works. His evidence was directed, among other items, to detailed figures of the work. He was cross-examined at length by Mr. LANGDON, and was in the witness-box for three successive days.

After Mr. *S. Youart*, a masonry inspector, had given evidence as to quarry costs,

Mr. *Basil Mackenzie* was called. As a contractors' engineer, he was of opinion that Mr. Kellett had not sufficient plant at Kinder to do the work.

In cross-examination by Mr. CRAIG, witness said he was only on the site once for three hours. He was further severely cross-examined as to the costs of stone dressing and working.

Mr. *James Waddell*, examined by Mr. PICKFORD, said he was engineer to Messrs. Morrison and Mason, Limited, who tendered for the Kinder work. He thought the quarries would not supply sufficient stone of the quality required. He gave the cost of doing different parts of the work. He did not consider Mr. Kellett's sample period (August to November) a fair one upon which to arrive at the cost of his work, because there was no bad weather in it.

In cross-examination by Mr. LANGDON, he admitted that the autumn in Derbyshire was particularly rainy. He went to the site at the request of Messrs. Hill and Sons, and was there about four hours.

Re-examined by Mr. PICKFORD, witness said one hour would be plenty for all there was to see.

Mr. *G. M. Nicholson*, a partner in the firm of Messrs. Northcroft, Neighbour, and Nicholson, quantity surveyors, examined by Mr. SUTTON, said he had gone into the figures of the contract. He did not think the profits made by Mr. Kellett, in the sample period, formed a fair criterion to go upon.

In cross-examination by Mr. CRAIG, witness agreed that he had acted in this case more as an accountant than as a valuer. He had not seen the daily returns. He did not consider they gave a better basis of calculation than the pay-sheets which he had taken. Taking a general average of the weather, Mr. Kellett's selected period to ascertain the cost was not unfair to the Corporation.

Mr. *C. O. Webb*, F.I.C.A., examined by Mr. BAILHACHE, said Mr. Kellett's books were incomplete. His further examination was directed to criticisms of Mr. Cooper's figures, the accountant for plaintiff.

In cross-examination by Mr. LANGDON, witness said he had given about a week or ten days to the examination of the books. He was further asked in detail as to the proper way of calculating profits, and as to items of capital charges, depreciation, &c.

Mr. *Harry Kellett* was recalled and examined by Mr. LANGDON, as to certain periods of the work, and as to its progress and stoppages, prices, &c. During the sample period, there was a stoppage of seven or eight full days.

After cross-examination by Mr. PICKFORD, as to certain actual or estimated figures,

Mr. *Abram Kellett* was recalled, and gave further evidence upon stone working and dressing.

Mr. *J. W. Madeley* was also recalled, and questioned as to the meaning attached to certain phrases in the specification relating to stones and joints.

Mr. PICKFORD, in summing up the case for the defendant Corporation, first dealt with three or four outlying claims, commenting, in opening, upon his not having called as a witness either Mr. Mansergh or Mr. Hawksley. Nothing had transpired to alter the opinions expressed in their reports, which had been put in by the plaintiff's Counsel, and so they had not been called. After dealing with lesser items, the claim of £16,194 for extra work upon the tongue-trench was discussed, as this had been agreed to be left to the Official Referee to deal with on a *quantum meruit* basis. The right plan to arrive at this, Counsel said, was to take the cost and put a reasonable profit upon it, not to take fancy prices. There had been no delay caused to the Contractor; and if there had been, that was within the Engineer's power according to specification. The important questions were: What was the contract? Had there been a breach of it? If so, what were the damages? The contract might mean: The contractor will build a watertight reservoir for £327,000; or the contractor will do the work shown on plans, &c. —the object being to build a watertight reservoir. But there was no implication that the Corporation were under an obligation to order any extra works necessary to make a watertight reservoir. The contract was an impossible one. There was no breach of contract by the Corporation, because the alterations constituted a new scheme.

Mr. LANGDON, in his reply, which occupied from two to three days, reviewed the whole history of the matter. This was a contract to do scheduled work at scheduled prices, with an obligation to allow the engineer to order such alterations as were specified. Various clauses of the specification and several letters were considered. The conflicting evidence of the expert engineers was commented upon. There no doubt was a breach of contract when the Corporation stopped the work. What would have been the natural sequence if the defendants had continued to do their duty?

JUDGMENT FOR THE PLAINTIFF FOR £52,546.

The OFFICIAL REFEREE delivered his judgment on Monday, the 4th inst. He found upon the facts or admissions that on May 12, 1903, Mr. Kellett entered into a contract with the Stockport Corporation for £248,724 15s. 3d., for certain of the work comprised in the specification, and for the execution of such work as might be ordered by the engineer at prices to be fixed upon. The contract price under the first tender was £327,000. On May 22, 1903, plaintiff was ordered to proceed with the work, and he brought down plant to the site, bought 13 acres of land for quarries, and leased other land. The original design showed tongue-trenches at the sides, but not in the centre. Two alterations were made by the engineer during the course of construction; a deep centre tongue-trench was added, and the foundations were deepened. In March, 1905, part of the intended foundations was found to be insecure, and Mr. Kellett so informed the engineer. In April, 1905, Mr. Ernest Mansergh contemplated a different profile; and in the following September he had a scheme to move the dam some feet down stream, to widen it, and to do further excavation, so as to make the dam as economical as security would allow. Between Aug. 6 and Nov. 11, orders were given to proceed with the work according to the amended plans. On Oct. 30, the Corporation stopped all the work except the tongue-trench. On Nov. 18, the Corporation said by giving orders they were not abandoning the contract, and therefore the plaintiff had to be ready to go on with it. On Aug. 2, 1906, the Corporation determined the contract, and revoked the licence to the contractor to be on the ground. Plaintiff's claim was for: (1) Balance of retention money and interest; (2) price of work done since the last certificate was given; (3) damages for delay; (4) value of work on tongue-trench; and (5) compensation for loss of profit which plaintiff would have earned.

The first defence set up was that it was impossible to build a masonry dam on the site. The learned Official Referee found as a fact that it was not impossible to make a stable and safe masonry dam. Never during the construction of the work did it occur to Mr. Madeley or to Mr. Mansergh that there was any impossibility.

The second contention was that this particular contract work could not be carried out, and that the alterations constituted a new contract. This could not be sustained in fact. The engineer under a clause in the specification had the power of varying the contract without reference to the Corporation.

In the third place, it was contended that the Corporation were entitled to rescind the contract by reason of the conduct of the plaintiff. Mr. Kellett had called attention to the bad piece of ground, and he would not hold himself responsible for building on it. But he never refused to execute the engineer's orders; and he repeatedly communicated his desire to go on.

Fourthly, it was said that there was no breach, because the defendants had the right to decline to order further work. The learned Official Referee decided that there was an implied obligation on the Corporation not to interfere with the engineer's orders. The engineer was not the mere servant of the Corporation.

The question of damages was next considered. The general principles upon which the learned Referee said that he acted were to recompense the plaintiff for part performance, and to give an indemnity for the part unexecuted. Contractors' profits were to be arrived at by minute examination into the actual cost. It was the duty of the tribunal to moderate the damages. The various items were then gone into, in order to ascertain the amount of damages to be awarded. As regards the compensation for loss of profit, this depended on different elements—some certain, and others conjectural. The estimate of profit on uncompleted work was almost wholly conjectural. There was a great body of conflicting evidence on the point. Witnesses for the plaintiff said he would have made a large profit. Taking the estimate of the defendants, there would have been a loss. The broad fact remained that Mr. Kellett had been deprived of reaping the benefit of his outlay; and he ought, therefore, to be awarded fair and reasonable compensation. The learned Official Referee estimated the contract price of work not finished at £361,000. This would have cost Mr. Kellett £328,100; leaving a surplus of £32,900. Deducting £3500 for contingencies, there was left £29,400, which was the sum awarded for loss of profits. Mr. Kellett's claim for indemnity for sub-contracts could not be allowed. The other heads of awards were: For retention money, £7571 16s. 10d.; for interest for 6 months at 4 per cent., £151 8s.; for uncertified work, £5475 4s. 11d.; for delay, £3696 4s. 4d.; for tongue-trench, £6252 5s. The total award, with that for loss of profits of £29,400, amounted to £52,546 19s. 1d., for which judgment for the plaintiff was entered, together with the costs of the action and counter-claim, both in Manchester and in London.

A stay of execution was asked for in respect of the item of £29,400; but, under the order of reference, the Official Referee did not think he ought to grant one, as it was not expedient.

Divisional Court.—Tuesday, Feb. 5.

(*Before Justices* PHILLIMORE *and* BUCKNILL.)

An application in regard to the decision above reported was made to-day to the Court as named.

Mr. BAILHACHE said this action came before Mr. Justice Lawrence at the Manchester Assizes, and was referred to be tried before Mr. Muir Mackenzie, Official Referee. The trial had occupied 23 days, and resulted in judgment being given against the Corporation for £52,000 odd as damages. The action was brought by Mr. Kellett against the Corporation for damages for breach of contract to build a large reservoir for supplying the town and neighbourhood of Stockport with water. The Corporation determined the contract, and the main question was whether the determination was rightful or wrongful. This had been found against the Corporation. The damages divided themselves under two heads. First, there was a sum of £22,000 for work and labour done and damages for delay. On this head, the Corporation did not propose to appeal, as they were essentially questions of fact for the Official Referee; and he having found against them, they submitted to his finding. But they did wish to appeal on the general head of breach of contract, the damages in respect of which amounted to £29,000. Upon this there were one or two questions of law to be determined, and he now moved for a stay of execution.

Justice PHILLIMORE: Did you ask the Official Referee for a stay?

Mr. BAILHACHE said he did; but Mr. Mackenzie declined to grant it, as he thought, having heard the action, he ought not to deal with the matter.

Mr. NORMAN CRAIG, in reply to their Lordships as to whether he objected to a stay, said, as regarded the £29,000, any question of law which his learned friend raised might affect *quantum*, but could not affect breach *in toto*; and he would suggest that if a reservation of £10,000 out of the £29,000 were made, it would amply cover any possible contingencies on appeal.

Mr. BAILHACHE said this was not quite so. At the very root of the matter of damages was the question as to what the contractor undertook to do by his contract. Did he undertake to build, in accordance with certain plans and specification, a water-tight reservoir? If he did so undertake, the defendants' contention in the Court of Appeal would be that there was no breach of contract on their part—that the contract as framed was impossible to perform, and that, at the most, the damage must lie where it fell. This would go to the whole of the £29,000. At the Manchester Assizes, the defendants paid a sum of £10,000, as they had in hand upwards of £7000 as retention-money which obviously had to be parted with; and he respectfully suggested that they should pay the difference between the £10,000 already paid and the £22,000, and that there should be a stay of execution on the other question of damage.

Justice PHILLIMORE: Your contention goes to the whole £29,000. Have you any subordinate question to make £29,000 too much?

Mr. BAILHACHE said there were subordinate contentions, the main one being this: There was power in the contract for the engineer to give orders for extras and to vary the contract. The variations in this contract increased the original one by more than 33 per cent.; and one of his contentions going to *quantum* would be that these variations were outside the province of the engineer, and, moreover, that the scheme which was formulated by the extras was essentially different from the scheme arranged and contracted for. The Official Referee had based his decision on the assumption that the orders for variation were rightly given. Before the engineer gave them, the Corporation dismissed him; and the point was made that there was undue interference by the Corporation with the engineer, who, in this respect, held an independent position, and whose duty it was to decide impartially between the two parties. This was a question the defendants desired to debate in the Court of Appeal.

Justice PHILLIMORE: If the plaintiff gets the £22,000, he will not be out of pocket, except as to interest and profits.

Mr. CRAIG: Except in this way, that my client bought 13 acres of colliery land, and had to incur a number of expenses.

Justice PHILLIMORE: Did the plaintiff complete the work?

Mr. CRAIG: No; it was a masonry dam, and at a certain stage the Corporation came to the conclusion that an earthwork embankment was sufficient.

Justice PHILLIMORE: We think there should be a stay of execution as to £12,000.

Supreme Court of Judicature—Court of Appeal.

Application was made on Saturday to Lords Justices Cozens-Hardy and Fletcher Moulton, for a stay of execution in respect of the sum of £29,400, part of the £52,000 odd which had been awarded as damages to the plaintiff by the Official Referee.

Mr. BAILHACHE represented the Corporation.

Lord Justice MOULTON asked whether the only issue was not this: Were the defendants justified, under the re-entry clause, in determining the contract?

Mr. BAILHACHE said the Corporation did not profess to determine the contract under the clause. They determined it on the ground that the contract was impossible of performance; and the question as to whether they were right or wrong depended on the construction of a very complicated contract. If they were right, it went to the whole £29,000; but if wrong, there were still other subsidiary questions arising on the contract which would go towards reducing the £29,000. The Divisional Court had granted a stay to the amount of £12,000; but since that decision was given, an affidavit had been filed on behalf of the defendants to the effect that the whole of the moneys coming under the contract had been assigned by the plaintiff to the Capital and Counties Bank. If the defendants paid Mr. Kellett or his assignees the £23,000, it was reasonable that they should have a stay in respect of the £29,000, having regard to the question of law which went to the root of the whole matter.

Lord Justice COZENS-HARDY asked if the defendants would bring the money into Court.

Mr. BAILHACHE said it was not suggested that his clients could not pay if they should be found liable.

Lord Justice COZENS-HARDY inquired whether the bank would undertake to repay the money should the Court so order.

Mr. BAILHACHE said the difficulty was that the bank was not there represented.

Lord Justice COZENS-HARDY suggested that the application should stand over till Monday—the bank to be communicated with in the meantime.

This suggestion was adopted.

The Court being constituted differently this morning—the Master of the Rolls presiding, in place of Lord Justice Cozens-Hardy,

Mr. BAILHACHE shortly recapitulated the nature of his application.

Mr. NORMAN CRAIG stated that he had been instructed to appear on behalf of the bank.

Mr. LANGDON, K.C., for the plaintiff, submitted that, on any view, some damage must be payable in respect of the breach, and there ought not to be a stay beyond £10,000.

Their LORDSHIPS suggested that it would be just and equitable to pay the money to the bank upon an undertaking to return it in the event of the Court so ordering.

Mr. LANGDON said the effect of this would be practically to cripple the plaintiff. As an alternative proposition, he suggested that the Corporation should retain the whole of the money on undertaking to pay interest at the rate of 1 per cent. over Bank rate.

Their LORDSHIPS thought this offer ought to be accepted.

Mr. BAILHACHE said the proposition was an entirely new one; but, upon the first blush, it did not appear to be an unreasonable one. He would consult his clients. If they consented, the order would go in that form; if not, the matter could be mentioned again.

DELIVERY OF COAL UNDER CONTRACT.

Action by the Edinburgh and Leith Gas Commissioners.

In the Court of Session, Edinburgh, on Wednesday last, Lord Salvesen closed the record in an action by the Edinburgh and Leith Gas Commissioners against the Kinneil Cannel and Coking Coal Company, Limited, of Glasgow, in which decree is asked for £309 15s. 2d. The Commissioners say that on April 8, 1904, the defenders offered to sell to them 6000 tons of Kinneil coking single nuts, at the price of 8s. per ton, delivered in railway waggons at pursuers' works at Granton. Subject to terms and conditions contained in the form of tender filled up and sent by the defenders' Secretary, the offer was accepted by the pursuers. On Nov. 2, 1906, when about 3470 tons had been delivered under the contract, the defenders intimated to the pursuers, by letter, that the contract must be considered as terminated. Since then the pursuers have repeatedly called upon the defenders to implement their contract; but they refuse to do so, or to make delivery of the balance of Kinneil nuts, amounting to about 2530 tons. In order to meet the requirements of their works, the pursuers have been under the necessity of obtaining other coal to replace the balance of nuts which the defenders were under contract to supply; and the price of coal having risen, they have had to buy at an increased cost of 2s. 5d. per ton. The sum sued for is the amount of extra cost which they have incurred in the purchase of this coal. The claim is made under the fifth condition of the defenders' offer, in which they agreed to repay any increased cost or expense, and any other loss which the pursuers might incur through the defenders' failure to deliver the quantity of coal contracted for.

The defenders admit the contract, but say that, by Article 1 of the tender, it is provided that "the coal hereby offered shall all be delivered during the period of twelve months, or such longer period, from the date of acceptance, at the Commissioners' option, in such quantities and at such periods as may be directed by your General Manager, addressed to us, in writing, from time to time." The period of twelve months expired on May 2, 1905. At the date of the expiry of the period of twelve months, the pursuers had only ordered 2600 tons under the contract; and by Nov. 31, 1905, the total quantity ordered was under 4000 tons, the greater part of which had been delivered by the defenders. On a sound construction of the contract, it is maintained, the pursuers were bound to order the whole 6000 tons within twelve months from May 2, 1904, or within a reasonable time thereafter. By failing to order the whole quantity on or before Dec. 31, 1905, at latest, the pursuers were in breach of their contract, and occasioned great loss to the defenders. In these circumstances, the defenders intimated to the pursuers that, in consequence of the pursuers' unreasonable delay in carrying out the contract, they declined to be further bound by it. The defenders have, however, offered to deliver to the pursuers 525 tons; and they repeat this offer.

In answer, the pursuers deny that they were bound, under their contract, to order the whole 6000 tons within twelve months from May 2, 1904, or before Dec. 31, 1905, at latest, or that they were in breach of their contract. They maintain that, prior to November, 1906, they had ordered the whole 6000 tons contracted for.

Fixing a Water-Pipe without Permission.

At the Bristol Police Court, last Tuesday, Frederick W. Jones, an engineer, was summoned for using water for purposes other than agreed upon, and also for fixing a pipe to a communication-pipe without the consent of the Bristol Water Company. It was stated that in March of last year the defendant asked the Company what the price of water would be to supply a gas-engine. An inspector informed him; and defendant replied that he thought the sum named was too much, and he would get his water elsewhere. In October a demand for the usual water-rate was served upon the defendant, and paid; but nothing was said about taking additional water for the engine. On Jan. 14 of this year, two inspectors visited the house and found that the additional pipe had been connected with the tank by means of an indiarubber tube. The inspectors questioned the defendant; and he said he had arranged with a representative of the Company to take a supply for the engine. There was no attempt to conceal the pipes. The defendant's Solicitor remarked that on both summonses there would have to be a conviction; but he thought it clear that no fraud or concealment was suggested. The defendant gave evidence to the effect that he had informed an inspector of his intention to use the water, after he had ascertained the price; and he quite believed he was paying for it. The Magistrates acquitted defendant of any fraud, and fined him merely a nominal sum, as the statute stated that permission must be in writing.

Action against the South Metropolitan Gas Company.—In the King's Bench Division of the High Court of Justice yesterday, Mr. Justice Ridley and a Common Jury had before them an action brought by Mr. George Paterson, a commercial traveller, against the South Metropolitan Gas Company for damages for injuries sustained by him through an explosion caused, as alleged, by negligence on the part of the defendants' servants. This was denied by the defendants. The plaintiff's meter had been disconnected, and was in the cellar of the house he formerly occupied. He went down to the cellar and struck a light, and the explosion followed. The Jury returned a verdict for the defendants, as they thought the accident arose from applying a light to the orifice of the meter. A full report of the case will be given next week.

MISCELLANEOUS NEWS.

PONTEFRACT GAS-WORKS PURCHASE ARBITRATION.

Surveyor's Institution.—Monday, Feb. 4.

(SIR HUGH OWEN, *Umpire.*)

This was an arbitration between the Pontefract Corporation and the Pontefract Gas Company in connection with the proposed taking over of the undertaking of the Company.

Mr. A. D. O. WEDDERBURN, K.C., and Mr. F. N. KEEN (instructed by Messrs. Baker and Co.) appeared for the Corporation; Mr. E. FORBES LANKESTER, K.C., and Mr. R. S. CLEASE (instructed by Messrs. Warwick, Webb, and Co., and Mr. Claude Leatham, of Pontefract) represented the Company.

Mr. FORBES LANKESTER, in opening, said that the arbitration arose in consequence of an Act obtained in the last session of Parliament by the Corporation of the Borough of Pontefract, for the purchase of the undertaking of the Pontefract Gas Company. Notice was given to the Company on Sept. 10 last that the Corporation proposed to purchase the undertaking, which meant the whole of the plant, machinery, and business. The district served by the Gas Company was practically the town of Pontefract and the parish of Carlton. The population, which had been steadily increasing, was about 14,000 to 15,000. The Company was a statutory concern under an Act of 1873, and succeeded a Company who were supplying without statutory powers. They were a maximum dividend Company; being regulated under the Gas-Works Clauses Act, 1847. They were unable to pay more than a certain definite amount annually on their capital—any surplus beyond that, excepting for certain matters such as reserve, went to reduce the price of gas. The original capital of £16,000 had all been raised, and the full 10 per cent. dividend had always been paid on this. A further sum of £16,000 had also been raised, and the full dividend of 7 per cent. paid on it. Then the Company had power to raise on mortgage £4000 in respect of each £16,000; but up to the present it had only been necessary to raise £5000 of this £8000—a sum of £2000 at 3½ per cent. and £3000 at 3¾ per cent. The money so raised was convertible into preference or ordinary shares, bearing interest at 5 per cent.; and he suggested that this would have to be taken into account. The actual income which the Company derived from their undertaking was sufficient to pay the interest upon all these classes of capital, and left a very considerable and increasing surplus. In the year ending June, 1906, the profits were £3228, which meant a divisible profit of £3045 10s.—a sum which, in all human probability, they would be able to continue to pay. This figure he should ask the Arbitrator to use as the multiplicand. There had been a steady growth of business from the beginning of the Company. The price had been coming down, and was at this moment at a figure which was somewhat below the average of similar companies in similar towns in similar districts. They were at present charging 2s. 11d. per 1000 cubic feet, which was very considerably below what they were allowed to charge—5s. 6d. Within the last eighteen months, they had been making strides in the sale of gas on the slot-meter system, and the result had been an immediate increase in the profits. The Company were now under more energetic management, and there could not be the complaint that they were not developing the business to the extent to which it was capable. Another point for consideration was the actual condition of the plant and works in their hands. When the matter was before Parliament, these were criticized as being larger than were wanted. Therefore, he contended, no new plant would be required for years. Then a further important point was as to the number of years' purchase. What had occurred to their experts was that the purchase should be put upon a 3½ per cent. basis, and that the figure which the Arbitrator ought to apply to the multiplicand as his multiplier should be 28·57 years; and taking the average of ten years (£2937 10s.), at 28·57 years' purchase, they would get a sum of £83,924. From this there would have to be deducted the £3000 of capital which had not been raised, which left a sum of £80,924. Then there was an allowance of 10 per cent. for compulsory purchase (£8092); making a sum total of £89,016, which was the amount claimed by the Company. The matter was simplified by the fact that the proposal was to buy the whole undertaking—"lock, stock, and barrel."

Mr. *Joseph Taylor*, J.P., the Chairman of the Company, and representing Pontefract on the West Riding County Council, said the works were extremely well situated. Pontefract had trebled in population within the last thirty years. There had been gradual progress since the Company started, excepting during one half year, when they lost the custom of the Union, who installed electricity because they would not pay the Company's price. But they were not pleased with the financial result. The Company had no fear of the competition of electricity. They had kept fully abreast of their consumption; and since the new Manager had been there, the sales of gas had largely increased by the introduction of slot meters, which the old Manager would not allow. They were now in a position to meet all demands for years to come.

Mr. LANKESTER: Have you been advised that you might introduce plant which would save a larger amount of ammoniacal liquor?

Witness: That is what we contemplated doing.

Anything of this sort which may be suggested would, of course, increase the profits?—Yes.

In your view, are the Company at this moment in a sound condition?—I consider so, quite.

If the Company continue to expand, you may want some extra expenditure in the way of mains?—Not very much; and the £3000 will cover any requirement likely to arise for years to come.

Mr. WEDDERBURN: You said in Parliament that the £3000 would probably last about ten years?

Witness: I do not remember saying that.

Is it not the fact that since 1902 the total increase in your sale of gas has been 92,000 feet?—I could not speak from memory.

If electric light comes into the borough, it will be a very serious competitor?—If there is a prospect of electricity coming into the town, why do the Corporation want the undertaking? My experience has been that where electricity has been introduced into a town, the gas company prospers.

Mr. LANKESTER: I believe you have been through that period of certain shrinkage owing to the introduction of the incandescent light, and are now coming round?

Witness: Yes.

Mr. *Laurence Whittaker*, the Manager of the Company, said that the excellent railway service meant that coal could be got cheaper. He described the buildings, plant, and machinery, and said the concern was in good order. He then went on to show that, by more economical working, the profits of the Company would go up. He illustrated this by saying that in 1905 the amount of gas made per ton of coal was 9610 feet, and the amount sold was 8885 feet; while in 1906 the amount made was 10,217 feet, and sold 9421 feet. They had very few complaints as to the gas. The revenue from the slot meters in the last half year was about £390, and the revenue per meter he should put at 30s. per annum.

Mr. CLEASE, dealing with the quantity of land held by the Company, asked: Is it a fact that the Corporation have applied to the Local Government Board for powers to construct a destructor?

Witness: Yes.

And the piece of spare land of the Gas Company would provide an excellent site for it?—That is so.

Mr. WEDDERBURN objected to this; remarking that the price of the land should be taken as the value to the seller and not to the buyer.

In further reply to Mr. CLEASE, witness said the percentage of houses taking gas in Pontefract at present was 50. The customers numbered 1455; and there were 1000 houses yet unsupplied. He did not consider the capacity of the retorts was excessive. The largest output of gas in 24 hours last December was 255,000 cubic feet; and the maximum capacity was 355,000 feet. He thought there was very considerable room for improvement in the business. Assuming that another 400 slot meters were fixed, the revenue from these, worked out on the basis of 30s. per year, would be about £600, and would result in an increased sale of gas of about 3½ million cubic feet. He thought there was a good field for heating stoves, which had not yet been touched. There was likewise a field for heating purposes generally. Incandescent lighting had been adopted throughout the town. So that the damage which could be done to the Company by the adoption of this means of lighting had already been done. This, he thought, accounted for the more or less two or three years' stationary character of the output. As to the electric light bogey, he could not say whether a Company gave notice of their intention to apply for a Provisional Order.

Mr. WEDDERBURN said a Company proposed to get a Provisional Order; but the Corporation thought it desirable that, if electric light was to come, the control of it should be in their hands. Therefore, they applied for a Provisional Order; and the Syndicate's notice had been withdrawn.

Witness gave further evidence as to the nearness of collieries, and as to the consumption of gas. He said that in 1905 the large consumers took about 7 million feet of gas; and these were only 17 per cent. of the whole.

In further reply to Mr. WEDDERBURN, witness said the installation of 400 more slot meters would cost about £1000; they would be 3-light meters. In the past, the extra cost had been made up by increasing the price of gas by 8d. per 1000 cubic feet.

Tuesday, Feb. 5.

Mr. *Laurence Whittaker* continued his evidence this morning. He agreed with Mr. Wedderburn that in 1906 the gross profits were £3564, which was about 1s. 8d. per 1000 cubic feet, as against £2878 and 1s. 4·39d. in 1905. Roughly speaking, it was an increase of £700. The increase in 1906 was 3·349 per cent., whereas in 1905 it was 3·960 per cent. Their coal contract ran out next June; but he did not think the price was likely to be less after that date.

Mr. WEDDERBURN put it to witness that a considerable amount of money was spent on land for which there was only a 2 per cent. return.

Witness replied that he had not gone into the matter; but it was a thing which occurred in all works.

Mr. LANKESTER: I have promised to call other witnesses who will tell you about these things.

Mr. WEDDERBURN: Now, as to expenditure on capital and revenue account. You agree that any replacement of works should be out of revenue and not out of capital?

Witness: Yes; but different companies have different ways of doing it.

But the sound principle is one which applies all over the world. If you are putting in a fresh thing which you have never had before, and which is entirely additional, that is capital; if you are replacing an old thing, that is revenue?

Mr. LANKESTER: Yes; I agree if you are replacing a thing in an exactly similar way.

Mr. WEDDERBURN next dealt with the mains; and asked if witness would advise a 1½-inch main nowadays?

Witness: Not unless it was for a single consumer.

Or a 2-inch main?—Yes, I should in some cases.

These 2-inch mains you think will never want replacing?—No; I do not say that. I cannot tell how many years it will be before the demand is too big for the main. If the demand does come, they will have to be changed, of course, and there will have to be capital expenditure to replace them in parts.

Has tar recently fallen from 35s. to 15s. 6d.?—It varies in different districts.

But it has fallen heavily; and that affects your bye-products?—Yes.

Mr. LANKESTER: But the price of coke has gone up, and that helps matters?

Witness: Yes.

Are your mains sufficient for the work you are now doing?—Quite.

At some time or other the mains would have to be increased; and you look to the £3000 of unraised capital as a source from which this can be provided?—That is so.

In further re-examination, witness said the leakage of gas was about 7 per cent.; and he considered this very small. He thought the business of the Company was in a good way. If they had not been disturbed, the business would have developed; and for some years to come they would have been in a position to pay full dividends and reduce the price of gas.

Mr. *S. H. Garside*, architect and surveyor, of Pontefract and Castleford, said he had valued the land and buildings of the Company.

Mr. WEDDERBURN admitted that the buildings, including the retort-house, were substantially built; but he complained that the retorts were out-of-date, and would need the expenditure of capital.

Witness gave his valuation of the land and buildings (excluding the gas-works, but including three cottages away from the works) at £7272 4s. 6d. Nearly half the members of the Corporation were in favour of the proposed dust destructor being erected on the surplus land at the gas-works when acquired. He disagreed with Mr. Wedderburn's suggestion that the value of property was decreasing in Pontefract; on the contrary, it was increasing.

Mr. *Ernest W. Drew*, of Messrs. Wood, Drew, and Co., bore out Counsel's statement as to the capital of the Company. The expenditure that had been charged to capital account was, in his opinion, proper capital expenditure, and none of it was in the nature of revenue account at all.

Mr. CLEASE: Do you remember, when the Bill was before the House, hearing the suggestion that we had improperly charged to revenue certain matters which ought to have been charged to capital account, and by doing so it kept up the price of gas?

Witness replied that this was his recollection of what occurred; but he repudiated the suggestion. He considered that the Company was a progressive one, and would have in future paid, and more than paid, their maximum dividend. Coal was supplied to the Company now at 9s. 9d. a ton, and with coal remaining as low, and having regard to the progress previously made, he was of opinion that the price charged for gas might reasonably have been expected to go below the present price of 2s. 11d. per 1000 cubic feet. He heard the allegations of mismanagement hurled at the Company when the Bill was before Parliament, and, as a business man, he ascribed the recent remarkable improvements to the new management.

Mr. CLEASE said that Mr. Stevenson (the principal witness on the other side), when before the House, agreed that, in a maximum price company, the value of the concern was more than half of its goodwill. He asked witness, remembering this, if it was fair to take the last price obtained by public auction as, to some extent, at any rate, an indication of the value of the undertaking.

Witness replied that he did not think they could do that, because there was considerable fluctuation in the price of gas stocks.

After Mr. CLEASE had pointed out that witness had misunderstood the question,

Witness said that the price obtained by auction would certainly be a much better guide than the price between private buyers.

Mr. CLEASE: In Parliament, did Mr. Stevenson say that, in nearly every case of arbitration, the shareholders of a company compulsorily acquired obtained more than they could sell their shares for in the market?

Witness: Yes.

And inasmuch as the price they could sell their shares for in the market was £84,479, would the price which (according to Mr. Stevenson) the Company will receive as the result of arbitration be more than £84,479?—Yes.

Wednesday, Feb. 6.

On the resumption of the proceedings this morning,

Mr. *W. A. Valon* said that he had inspected the area of supply of the Company. There were three railway stations there, and the district was in the neighbourhood of collieries. The number of consumers in 1906 was 1440, against 1217 the previous year, which was about 50 per cent. of the total number of possible consumers. He should say that probably two-thirds of the remainder might be consumers in the future. This showed that the district was not worked out, but that there were probabilities of development even as it now stood. As to the works being largely in excess of requirements, there was no doubt that the margin was greater than was absolutely necessary. There should be a two years' margin for emergencies; and when works were constructed, they should be built with about, seven years in view. For the moment, however, the percentage of margin was, he thought, larger than it need be. As extensions were made in the future, there was no doubt that regenerative gas-furnaces would be used, and the alteration would pay for itself. He had examined the retorts themselves, and they were in good order. He agreed that they ought to have some plant for the manufacture of sulphate of ammonia, as it was a good source of revenue to a gas undertaking; but it would not require a very expensive plant to make the conditions suitable for its manufacture. He said that, in buying an undertaking of this kind, they were buying the security for the divisible profits. The whole of the loan capital was convertible into share capital bearing interest at not more than 5 per cent. He thought it was fair to say that 5 per cent. on £8000 were profits which might be divided by the Company. These were profits which the Corporation should buy when they took over the concern, less, of course, the actual sum which was being paid as interest upon the mortgages. Some time ago the introduction of incandescent gas-lights affected the Company; but in the last two years this had been made up. If the introduction of electricity followed the usual course, it would increase the consumption of gas. He considered 7½ per cent. of leakage was a very low figure. The pressure on the mains was a high one; and if they were not sound, there would be a greater leakage. Slot meters meant larger profits. There would, of course, be an expenditure on mains if the system expanded; but the works were enough to manufacture for many years to come the gas that would be required. Gas-cookers would also be a future source of revenue. There was no doubt that the Company, if undisturbed, would continue to pay their full dividend for a practically indefinite period. In his valuation, he had arrived at the figure of £2937 10s. as his multiplicand; and he had applied the multiplier of 28 57 years' purchase on a 3½ per cent. basis. In this way he made the value of the undertaking £80,924. Then there should be added 10 per cent. for compulsory purchase, which would bring the total value of the shareholders' interest to £89,016.

Mr. WEDDERBURN first cross-examined on the insertion in the claim of the £3000 loan capital which was unissued, and suggested that witness had never put such an item in a claim before. He did not claim it in the similar circumstances of Morley and Skipton.

Witness replied that he could not recollect the circumstances; but there might have been reasons in those cases which guided him in the direction he took at that time.

Mr. WEDDERBURN: What the Umpire has got to arrive at is to see that each shareholder in the Company gets an income equal to his shares.

Witness: Not the value of the shares only, but the value of the security behind them. If the shares on the market might fetch £5 to-day and £6 to-morrow, the market might be an indication of what the value is; but when you come to realize the security, it must be greater than the value of the shares, because the security secures the payment of the dividend on these shares. Therefore, you must clearly buy the security.

Is not what the Statute says that the shareholder is to have his maximum dividend?—Yes; but you must go further than that. He has also the security by which the maximum dividend is secured.

With regard to the question of the £3000 unissued loan capital, can you give any case other than this in which you have claimed it?—No; this is the first case I have had where there has been anything of this kind to claim, or otherwise I should have claimed it.

In further cross-examination, witness said, as to the 10 per cent. for compulsory purchase, that a considerable sum was generally allowed by the arbitrator—always something, but not always 10 per cent. He must claim 10 per cent. on behalf of the sellers; but it was in the discretion of the arbitrator to say what the percentage should be. He did not know that there was an agitation in Yorkshire, by prepayment consumers, who objected to pay more than others.

Mr. *Henry Tobey*, the Engineer of the Malton Gas-Works, corroborated what had been said by the previous witness as to the Pontefract works being in good condition, well maintained, and in excess of the present demand. The superabundance of works, far from detracting from the value of the undertaking, added to it and increased the security. He considered the style of the retorts was a very common one round the neighbourhood; but they could be altered at little cost nto regenerative retorts at (say) £40 per setting. This would effect a great improvement both in gas and coke for sale. He thought the price of gas was reasonable.

In reply to a question as to the effect of electric lighting competition, witness said that his experience generally of companies in his own neighbourhood was that the consumption of gas had not been materially affected by the introduction of the electric light. He instanced York, Scarborough, Bridlington, and Harrogate, and said he had gathered from inquiries that the effect was not material. It might give a slight check when it first came into operation; but gas finally succeeded in overcoming it, and eventually increased the consumption. He agreed there was a large field not yet developed for the sale of gas. He thought there was a field in Pontefract for four times the quantity of cooking stoves as at present, and also for the development of the slot-meter system. He agreed with Mr. Valon's valuation.

Mr. LANCESTER: Do you regard these shares as equal to a trustee security?

Witness: I do; undoubtedly the security is a splendid one.

Mr. *H. E. Jones*, who was the next witness called, said the works were considerably in excess of present requirements; and this was a most distinct advantage to the Corporation. If it were not a statutory undertaking, he should claim for this surplus a separate sum. The works as they stood justified the capital expenditure on them. The capital expenditure per million cubic feet of gas sold (£848) was not unreasonable—considering the small amount of gas sold, the fact that prepayment meters had only lately been taken up, and that a good deal was represented by the excess works. With an expenditure of about £8000 on the mains, the undertaking could do a business of 60 million feet per annum, instead of the 42 millions at the present time. Allowing 5 per cent. on the outlay, this would bring the dividend down from 1s. 4½d. to 1s. 0¼d. per 1000 feet. The following facts made for the stability of the Company and the maintenance of the maximum dividends: There was a low capital expenditure and a low charge for dividend; the works were substantial, and had ample area for development; there must be considerable addition to the revenue from coin-meters, stoves, &c.; and the works were not only in good condition, but the expenditure shown in the accounts was sufficient. He agreed with Mr. Valon that the number of years' purchase should be roughly 28½; and to this he suggested the addition of 10 per cent. for compulsory purchase. His total valuation was £88,781.

Mr. CLEASE asked witness whether, if the Corporation had to raise £90,000 at 3½ per cent. to take over the Company, it would not be reasonable to compensate the shareholders to the extent of enabling them to obtain an equal income by investing in Corporation stock.

Mr. WEDDERBURN objected to the question.

The UMPIRE said Mr. Clease must agree that there was a difference between the shares of the Gas Company and the Corporation stock, which had the security of the whole of the rates behind it.

In cross-examination by Mr. WEDDERBURN, witness said he was constantly investing for friends in gas stock; and gas stocks, instead of depreciating at present, as one witness had stated, were standing uncommonly well. He maintained that gas stocks were hardening up to a 4 per cent. security, as they were in 1898.

Friday, Feb. 8.

The case for the Company having closed on Wednesday,

Mr. *E. Herbert Stevenson*, called upon by Mr. WEDDERBURN, said that such a sum ought to be provided for each shareholder in the Company as would enable him to get equal terms on equal security. Any sum which enabled the present shareholder to double his income was necessarily a wrong figure. The *crux* of the whole case was the

question of the security of the concern. He had come to the conclusion that a company should not claim in arbitration for those things which they might have done for a long period of years, but which they had not done. For instance, the Company might have made a large profit from the manufacture of sulphate of ammonia; but they had neglected to do so. The year 1906 was their best one, and should not be taken as a basis of the Company's business. First of all, this was due to the exceptionally low price of coal in that year. The average price of coal for ten years was 3·33d. per ton above that in 1906; and this resulted in the expenditure in the latter year of £593 less than the average. It was the general opinion that the price of coal had risen, and would rise, all over the kingdom. Turning to the excessive works, he said it had been claimed that the undertaking was more valuable because of this; but it was quite evident that if, for instance, a gasholder was twice the size needed, the cost of repairs must be more than if it was of normal size. In his opinion, a sum of 2d. per 1000 feet of gas ought to be added to the cost of repairs. The Company would not in the future be able to earn their maximum dividend any more than in the past. In the last five years, they had not been able to earn the dividend in three of these years; and in only one year had they any surplus whatever. Shares in a small gas company such as this could not be regarded as of equal value to first-class commercial shares or of corporation stock. He objected to the statement that gas stocks generally were hardening up to 4 per cent. Sheffield gas stock was as nearly as possible 4 per cent.; but that stood at the very tip-top of all gas stock, and had done so for some period. Just recently prices had rather receded than grown. Every gas company had power to raise the price of gas; but they did not like to do so, because they at once found a reduced consumption. He could not say, of his own knowledge, that the reason why the Guardians left the Pontefract Gas Company and adopted electric light was because the Company refused to reduce the price of gas. He did not think there was a very large field for slot-meters. If they extended their business, they would have to come to Parliament for further capital. The sum that could be raised at present was needed to pay, among other things, the debt at the bank. He denied that there was no overdraft, asserting that it amounted to more than £1000. He did not think the population of Pontefract was likely to increase very much. Excessive works were a burden to an undertaking; and the Company asked for an enhanced value in respect of them, and, in addition, it was a depreciating burden. They were asking the Corporation to pay £22 for every £10 invested in bricks and mortar. Of course, a gas company must always be a little ahead of the demand. These surplus works were what might be called "excess surplus." They were a burden until they came into use, because they were dead capital. He agreed that generally the buildings were in good condition. The retorts were old fashioned. If they had been modern ones, of course, the profits would be increased; but in order to do this they would have to spend fresh capital. The claim made in respect of the small mains was, in his opinion, unprecedented. From an engineer's point of view, all gas-mains under 3 inches in diameter were wrong. Respecting the change made from ordinary to prepayment meters, the ordinary meters would never be used again in Pontefract, and they ought to have been scrapped. He claimed that it was improper to charge the cost of them to capital. It was unfair to regard the old meters as marketable stock. There was a lot of surplus land; and a good deal of the money expended on it must be regarded as dead capital. He calculated that the loss added 1⅓d. per 1000 cubic feet to the cost of gas. There was practically no reserve fund now; and it was an element of security that there should be a reserve fund. He regarded £60,438 as a fair price to be awarded. This would produce the annual income of £2720 if it was a security on a 4½ per cent. basis. He would add nothing in regard to the conversion of capital, nor for compulsory sale, as was suggested by the Company's witnesses.

In cross-examination by Mr. LANKESTER, witness said that Parliament would have looked at a company suspiciously who had converted their borrowed money into capital—more so now than in 1899. Ossett and Devonport, he thought, were cases in which there was a right to convert borrowed money into capital, and no claim had been made in respect of it. He did not think the maximum dividend was well secured in the case of Pontefract.

Mr. LANKESTER quoted from the speech of Mr. Wedderburn before the Parliamentary Committee, in which he said: "This is a case in which the maximum dividend is well secured." He then asked: Is it your opinion that the difference between a statutory and a non-statutory company is about 1 per cent.

Witness: That is my general opinion.

Is it not a fact that the Company have earned their maximum dividend from the beginning?—I have said that all along. But they have not earned it during the last ten years. We are not buying the profits which the Company earned 20 or 30 years ago. We have to look forward to the future now; and it is only the immediate past which tells us what the profits of the future will be.

Alderman *Charles Lowden*, of Pontefract, also gave evidence, in the course of which he said he should imagine that the surplus land of the Company was one of the worst sites that could be picked in Pontefract for building purposes.

The proceedings were then adjourned till yesterday (Monday).

Carburetted Water-Gas Plant for Nelson.—The Nelson Gas Committee are arranging to erect a carburetted water-gas plant at their Brierfield works, at an estimated cost of £4200. The consumption of gas has been increasing to such an extent that it is absolutely necessary to take some steps in order to meet the demand before next winter comes round.

The Dibdin-Woltereck Gas-Making Process.—According to a paragraph which appeared in the "Financial News" last Wednesday, "negotiations are proceeding at No. 3, Edinburgh Mansions, Howick Place, Victoria Street, and at No. 102, Ashley Gardens, S.W., for the formation of the Dibdin-Woltereck Gas Company. Captain Lomax and Mr. J. Corah are in charge of the preliminary arrangements." The process referred to has already been described in the "JOURNAL."

BRISTOL GAS COMPANY.

A Record of Progress.

The Annual General Meeting of this Company was held in the new offices, Colston Street, Bristol, last Thursday—Mr. J. W. S. DIX, the Chairman, presiding.

The SECRETARY (Mr. John Phillips) having read the notice convening the meeting, the report of the Directors was presented. It was stated therein that the revenue account for the past year showed a profit of £71,966, which, with £39,514 brought forward, made a total of £111,480 available for interest on the debenture stock and dividend on the general capital stock. The debenture interest for the year amounted to £11,824, and the interim dividend on the general capital stock for the half year ended June last to £28,562; making a total of £40,387, and leaving a balance of £71,093. The dividend for the half year to the 31st of December would absorb £29,312; leaving £41,780 to be carried to the credit of the next account.

The CHAIRMAN, in moving the adoption of the report, said it gave him very much pleasure to welcome so large a number of proprietors in their new building. The Directors were pressed by people outside to provide them with more convenient offices than those at Canons' Marsh; but their answer was that consumers were called upon by collectors, and that they need not trouble to go to Canons' Marsh. The reply was that it was not always convenient to pay the collector. When, however, the Canons' Marsh Railway was made, it became obligatory to obtain a site for new offices. There they were now, and he trusted the proprietors were pleased with the premises and their position. Convenience was afforded to customers to pay their accounts, and there was also a show-room—for grates, stoves, pendants, brackets, and so forth—which was one of the best in the West of England, where people might make their choice of gas fittings and appliances. So far as this department was concerned, the Company did not desire to enter into unfair competition with plumbers and ironmongers, but rather to help and encourage them. He believed this policy would meet with the approval of the shareholders. All they wanted to do was to sell gas; and the more they could help local tradesmen to sell their appliances, and thereby increase the consumption of gas, the better the Directors would be pleased. He thought the accounts were very satisfactory. There had been an increase in customers, and in cookers; the former being more than last year by 2905, and the latter by 3366. The progress of the Company from the beginning was shown in some figures he would lay before the meeting. Last Monday week was the hundredth anniversary of the lighting of a certain street in London by gas. Bristol did not begin quite so early. The Bristol Gas Company (St. Philip's) was incorporated in 1819; and the Bristol and Clifton Oil Gas Company in 1823. In 1836 power was taken to use coal; and in 1847 the name was altered to the Bristol and Clifton Gaslight Company. In 1853 the two Companies were amalgamated, under the style of the Bristol United Gaslight Company; and in 1891 the name was altered to the Bristol Gas Company. He had before him a table [see p. 418] showing their progress since the year 1852. It was in 1892 that the day consumption of gas began, and there were sold 435 million cubic feet. Since then the use of gas for cooking and heating had gone up enormously; and he thought the figures were exceedingly satisfactory. They showed the solidity of the concern. When electricity was introduced, some people predicted that it would extinguish gas. But these folk ought not to have prophesied until they knew. People talked about the convenience of electricity, and as to how they could switch it on and off. Well, the same could be done with gas. [A demonstration was given by Mr. Phillips.] Other inventions were in progress; and they did not know yet what they would be. But even at the present time he thought they had reached a fair state of proficiency. Hence gas could compete with electricity not only in lighting, but in other ways; while the difference in expense was very considerable. The Company were in the pleasant and happy position of having earned their dividend and carried over a handsome balance. He thought he ought not to conclude his remarks without alluding to another matter. He did not want to do any croaking; but there was nothing like looking things straight in the face. At present the coal market was in a peculiar state; and if they had to pay a higher price for their coal, they must make provision for meeting the extra charge. Unless they were actually driven to raise the price of gas, they would not do so. They would try every method to continue to give customers cheap gas; and if they should be obliged to raise the price, it would be very much against the wish of the Directors, and would only be done out of sheer necessity, to enable them to meet their obligations.

The DEPUTY-CHAIRMAN (Mr. G. K. Stothert) seconded the motion.

Mr. P. K. STOTHERT referred to the large increase in the rates which the Company had to pay, while, on the other hand, they received £1600 less than last year for public lighting. Therefore, while they paid much more in local taxation, they received a great deal less from the city. In the neighbouring town, with which he was associated [Bath], the electric lighting concern, which was owned by the Corporation, had been trying to make a profit, but had failed. The Corporation were about to part with their works to a Syndicate, who would pay for them a handsome sum, which he hoped would be applied in a reduction of the rates. He was connected with the Gas Company there, and would have to face competition; but he preferred doing so with a private concern than with a corporation-owned undertaking, which had the backing of the rates. He feared, however, it would be a long time before Bristol would part with their electricity works to a Syndicate, though he did not think their accounts were any more satisfactory than those of the Bath concern. If this step were taken, the rates would be relieved, and the Gas Company would be placed in a more favourable position in regard to competition.

The CHAIRMAN replied that the Bristol Gas Company would not object to competing with a private company; but it was unfair to compete with a corporation-owned concern, with the rates at its back. He believed that if the accounts of the Bristol undertaking were properly set forth, they would show a loss, and not a profit. He considered there was room for both electricity and gas. Regarding the smaller

sum received for public lighting, this resulted from the price charged being reduced from 2s. to 1s. 6d. per 1000 cubic feet. The Company tried to get Parliament to make certain changes in their powers; but they would not let them charge one customer less than another. So, having reduced the price to the Corporation, they had to do the same to the public. Consequently, they charged 1s. 6d. per 1000 cubic feet of gas employed for motor purposes, and gave the same advantage to people who, using large quantities of gas, paid their accounts promptly. The latter had an astonishing effect in inducing dilatory people to pay.

The motion was carried.

The retiring Directors (Mr. G. K. Stothert and Rev. P. R. Sleeman) and Auditor (Mr. H. Grace) having been re-elected, a dividend of 5 per cent. per annum for the half year ended Dec. 31 was declared, and the proceedings closed.

After the meeting, many of the shareholders present went over the new offices and inspected them.

The following are the particulars referred to by the Chairman in the course of his address :—

Year.	Capital Expended to Date.	Amount to the Credit of Reserve Fund.	Rates and Taxes Paid during Year.	Coal Carbonized.	Gas Made.*	Selling Price of Gas.†
				Tons.		
1852	..	..	..	..	190	4/6
1862	£255,388	£15,287	£1,294	47,910	389	3/9
1872	369,154	27,173	2,252	74,615	634	3/- to 3/6
1882	697,110	38,143	5,587	109,216	1010	2/10
1892	831,547	49,054	7,359	176,352	1658	2/10
1902	1,158,814	106,470	8,962	239,650	2285	2/3
1905	1,263,047	113,794	10,987	253,987	2489	2/-
1906	1,305,665	116,350	11,886	258,946	2560	2/-
Inc. for Year .	£42,618	£2,556	£899	4,962	71	..

* In millions of cubic feet. † Per 1000 cubic feet.

Year.	Storage Capacity of Gasholders.	Total Length of Main Laid.	Total Meters in Use.	Prepayment Meters in Use.*	Cookers on Hire from the Company.†	Public Gas-Lamps in Use.
	Cub. Ft.	Miles.				
1852	..	..	..	..	..	3004
1862	1,700,000	108	..	..	..	3308
1872	3,400,000	150	15,800	..	..	3732
1882	6,600,000	208	19,916	..	..	5083
1892	8,300,000	264	22,384	20	2,193	6733
1902	15,000,000	338	35,225	6,955	19,560	8943
1905	15,000,000	350½	44,711	13,511	30,327	9217
1906	15,000,000	355	47,616	16,157	33,693	9325
Inc. for Year .	..	4½	2,905	2,646	3,366	103

*Commenced hiring out in 1891. †Commenced hiring out in 1888.

The following figures show the increase in the consumption of gas during the hours of daylight: In 1892, it was 435 millions; in 1902, 934 millions; in 1905, 1043 millions; and in 1906, 1093 millions—an increase last year of 50 millions.

COMMERCIAL GAS COMPANY.

The Half-Yearly Report and Accounts.

The following is the report for the half year ending Dec. 31 last which the Directors of the Company will present at the ordinary general meeting of shareholders on Thursday.

The revenue account shows a net profit for the half year of £64,526 4s. 6d., which, added to the balance of £19,409 17s. 7d. brought forward from last year, produces a net revenue balance of £83,936 2s. 1d. Deducting therefrom £9463 10s. 10d. for interest, there remains standing to the credit of the net revenue account a balance of £74,472 11s. 3d. available for dividend.

The Directors recommend the payment of dividends thereout at the rate of £5 4s. per cent. per annum on the 4 per cent. stock of the Company, and of £5 per cent. per annum on the 3½ per cent. stock, both less income-tax. The balance of the net revenue will be carried forward to the next half year.

The Right Hon. Sir John Colomb, K.C.M.G., and Mr. J. G. Pilcher, two of the Directors, retire by rotation, and, being eligible, offer themselves for re-election.

Mr. S. W. Savage, one of the Auditors, will go out of office by rotation, and, being eligible, offers himself for re-election.

The accounts accompanying the report consist of the usual statements. They show that the paid-up stock on the 31st of December amounted to £926,405; that £1,076,875 had been added by conversion, making £2,003,280; and that £222,445 remained unissued out of the total authorized (including premiums) of £2,235,000. The total amount borrowed on the above-named date was £339,062 10s., and £135,937 10s. was added by conversion; making a total of £475,000, and leaving £79,226 to be borrowed out of the £550,000 authorized. The receipts on capital account amount, with premiums, to £2,598,057 9s. 7d. The expenditure stands at £1,385,244 19s. 7d., with a nominal amount of £1,212,812 10s. added by conversion—together, £2,598,057 9s. 7d. There is consequently a balance of £65,139 15s. 2d. carried to the balance-sheet. The expenditure on capital account in the half year was £15,309, apportioned as follows: New and additional mains, services, &c., £3270; stoves, £3029; prepayment meters and fittings (less £6583 written off for depreciation), £9010. The reserve fund amounted to £33,588; and the insurance fund to £32,177. The following is the revenue account.

Expenditure.

Manufacture of gas—			
Coal and oil, including dues, carriage, unloading, and trimming	£91,519 9 3		
Salaries of Engineer and officers at works	2,145 0 0		
Wages (carbonizing)	18,330 15 6		
Purification, including labour	1,723 0 3		
Repair and maintenance of works and plant, materials, and labour, less £299 3s 3d. received for old materials	25,523 18 10		
		£139,247 3 10	
Profit sharing		3,135 5 4	
Distribution of gas—			
Salaries and wages of officers and rental clerks	£3,620 16 3		
Repair, maintenance, and renewal of mains and services, material and labour	5,998 0 2		
Repair and renewal of meters	2,829 11 8		
,, ,, ,, ,, stoves	6,493 10 1		
,, ,, ,, ,, prepayment meters and fittings	7,881 0 1		
Incandescent mantle maintenance, &c.	514 0 4		
		27,336 18 7	
Public lamps—lighting and repairing		2,586 10 0	
Rent, rates, and taxes		13,184 1 2	
Management—			
Directors' allowance	£1,250 0 0		
Company's Auditors	75 0 0		
Salaries of Secretary, Accountant, and clerks	1,183 8 9		
Collectors' salaries and commission	1,639 19 8		
Prepayment meter collection	2,043 12 5		
Stationery and printing	1,004 1 8		
General charges	1,135 12 3		
		8,336 14 9	
Bad debts		1,149 19 0	
Law and parliamentary charges		250 2 0	
Superannuations and allowances		938 16 2	
Official officers		97 19 6	
Total expenditure		£196,263 10 4	
Balance carried to net revenue account		64,526 4 6	
		£260,789 14 0	

Receipts.

Sale of gas—			
Common gas per meter at 2s. 5d. per 1000 cubic feet (80,023)	£187,273 13 10		
Public lighting and under contracts, common gas	5,946 15 8		
	£193,220 9 6		
Less discounts and allowances	3,322 7 6		
		£189,898 2 0	
Rental—			
Meters (24,257)	£2,878 17 1		
Stoves (45,119)	7,202 15 3		
Prepayment meters (54,968)	12,042 12 11		
Incandescent mantle maintenance	435 10 4		
		22,559 15 7	
Residual products—			
Coke, less £4502 16s. 11d. for labour	£28,316 10 7		
Breeze, less £595 6s. 3d. for labour	2,937 12 2		
Tar	6,722 10 10		
Ammoniacal liquor and sulphate of ammonia	10,280 3 8		
		48,256 17 3	
Miscellaneous receipts—			
Rent receivable	£45 15 0		
Transfer fees	29 5 0		
		75 0 0	
Total receipts		£260,789 14 10	

The following are the statements relating to the manufacturing operations of the Company in the half year.

Statement of Coals and Oil.

Description.	In Store June 30, 1906.	Received During Half Year.	Carbonized During Half Year.	Used and Sold During Half Year.	In Store Dec. 31, 1906.
	Tons.	Tons. cwt.	Tons.	Tons. cwt.	Tons.
Common	25,975	106,969 10	110,431	515 10	21,998
Cannel	2,508	..	220	..	2,288
Total	28,483	106,969 10	110,651	515 10	24,286
Oil—gallons	396,291	1,002,830	1,086,988	..	312,133

Statement of Residual Products.

Description.	In Store June 30, 1906.	Made During Half Year.	Used During Half Year.	Sold During Half Year.	In Store Dec. 31, 1906.
Coke—tons	3,917	67,773	18,286	49,523	3,881
Breeze—tons	491	14,222	..	14,058	655
Tar—gallons	510,131	1,209,088	..	1,040,208	679,011
Ammoniacal liquor—butts	3,315	34,811	29,303	..	8,823
Sulphate of ammonia—tons	85	930	..	968	47

Statement of Gas Made, Sold, &c.

Quantity Made (meter register and estimated).	Quantity Sold.		Quantity Accounted for.	Number of Public Lights.
	Public Lights and under Contracts (estimated).	Private Lights, per Meter.		
Thousands.	Thousands.	Thousands.	Thousands.	
1,721,587	41,813	1,554,869	1,622,504	4080

The remaining statement is the balance-sheet, which gives the value of the stores in hand at the close of the half year as follows: Coal, oil,

&c., £19,124; coke and breeze, £2349; tar, ammoniacal liquor, sulphate, &c., £7619; sundry stores, £31,583—total, £60,675. A sum of £17,978 stands in the balance-sheet as employees' bonus and savings. The figures this time last year were: Coal, &c., £19 141; coke and breeze, £3597; tar, &c., £7717; sundries, £26,476—total, £56,931. Employees' bonus and savings, £12,938.

INVESTIGATION OF STOCKPORT GAS ACCOUNTS.

The question of the method of keeping the Stockport Corporation gas accounts, which has been discussed by the Council on numerous occasions, has now been the subject of a report (see "JOURNAL," Dec. 11, p. 771) by a Special Committee, who were appointed to go into the matter after a Sub-Committee chosen by the Gas Committee had already reported. The Special Committee, after a thorough investigation of the books, find that there have been irregularities in the keeping of the accounts; that the system of book-keeping is not what is required for such an important undertaking; and that in the interests of the Gas Department it was necessary that a new Chief Clerk should be appointed, and that a thorough reorganization of the office staff should take place. They recommended that, in conjunction with the Borough Treasurer, an experienced firm of chartered accountants should be consulted with a view of instituting a proper system of book-keeping; that a new Chief Clerk should be appointed; and that an appointment in another department of the Corporation should be offered to the present Chief Clerk (Mr. Thomas Bedford). When, however, the matter came before the Council, the following amendment was, by 25 votes to 11, substituted for the recommendations of the Committee: "(1) That the Gas Committee be instructed to consult a firm of experienced chartered accountants to advise them, in conjunction with the Borough Treasurer, as to the institution of an approved system of book-keeping. (2) That the present Chief Clerk of the Gas Department be dismissed from his position. (3) That a gentleman of business experience and a full knowledge of accountancy be advertised for and engaged as Chief Clerk. (4) That the Special Committee submitting this report be requested to inquire and further report what suitable appointment (if any) can be offered to Mr. Thomas Bedford in some other department of the Corporation."

COMPARISON BETWEEN MANCHESTER AND SHEFFIELD.

On the Gas Committee's report being submitted at last week's meeting of the Manchester City Council, the Chairman (Alderman Gibson) was asked by Mr. Clyne whether it would not be well for the Committee to adopt the manufacturing and administrative methods of the Sheffield Gas Company. He said he thought Manchester gas should be as cheap as that supplied by a private company.

In reply, Alderman Gibson remarked that he had dealt with a similar question in respect of Sheffield many times before; and he wanted his statement that day to be his final answer. If Mr. Clyne would take the trouble to look at "Field's Analysis" for 1905, which was recognized as the standard work on all gas matters, he would find manufacturing charges (which included salaries, wages, purification, and maintenance of plant) to be as follows: Manchester, 5·59d. per 1000 cubic feet of gas sold; Sheffield, 7·52d. Manchester secured 500 cubic feet of gas more out of every ton of coal carbonized than did Sheffield; and leaving out the cost of coal and the amount received for residuals, they put gas into their holders at a less cost than Sheffield. If Manchester adopted Sheffield methods, Manchester would be worse off. Besides this, Manchester had prepayment meters, which Sheffield had not. Manchester, too, gave free meters, free boiling-burners, free grillers, and free cooking-stoves, which meant giving their customers, and taking out of their profits, £30,000 a year. Sheffield charged for all these things. Again, they gave £1000 a week out of their profits towards the relief of the rates. The fact was, that with what they had control over they did much better than Sheffield. Sheffied paid 4s. per ton less for coal than Manchester, and obtained much higher prices for residuals, owing to local conditions over which his Committee had no control. Sheffield could sell gas cheaper than Manchester, as the result of more favourable local conditions.

The report of the Committee was approved.

A Candid Opinion of Electricity at Newport.

The statement of affairs which Mr. R. Laybourne, the Chairman of the Newport (Mon.) Gas Company, had to lay before the shareholders at the recent half-yearly meeting was of a very gratifying character. He said that during the six months there had been an increase of 5,074,000 cubic feet in the quantity of gas sold to the public, compared with the corresponding half of the previous year, requiring the consumption of additional coal of the value of £12,005. The sale of residuals showed an improvement. As a result of the working for the half year, the Company had carried to profit and loss account £127 more than in the last six months of 1905, which enabled the Board to pay the statutory dividend without recourse to the reserve fund. The number of cookers added during the half year was 774, making the total now in use 10,268; and of gas-fires the number added was 192, making a total in use of 3054. The report having been adopted and the dividends having been declared, Mr. Thomas Canning, the Engineer and Manager, referred to the opposition of electricity, and remarked that neither now nor in the past had he looked upon the matter in Newport otherwise than in the way of so much waste current—for the simple reason that there was a better light to be obtained much more cheaply. Electricity would scarcely have been put in use at all for lighting, except as an article of luxury, had it not been taken up by the municipalities as a sort of foster-child. It had been so taken up for two reasons—viz., because it was new, and because it was expensive. For lighting, for heating, and for cooking gas was holding its own; but it behoved those interested in gas to keep their eyes open to improvements.

NOTTINGHAM GAS CONTROVERSY.

Appointment of the New Committee.

In accordance with the resolution come to last month by the Nottingham City Council—and duly recorded on p. 167 of the "JOURNAL"—"that a Special Committee of five members be appointed to hold a public inquiry into the working of the gas undertaking during the past five years," the names of the gentlemen chosen were submitted to, and approved by, the Council at their meeting yesterday week.

The matter was adjourned in the first instance in order that Alderman Fraser and Sir John M'Craith, the leaders of the two parties in the Council, should endeavour to agree upon the names of those to serve; and the appointment of the Committee was the first business on the *agenda* at last week's meeting. It was announced, however, that although Alderman Fraser was ready with his names, Sir John M'Craith was not; and the consideration of the matter was thereupon relegated to a later stage in the proceedings. When the Council were about to rise, Sir John M'Craith said there seemed to be a great difficulty about the appointment of the Committee; but he would suggest Mr. E. M. Elborne and Dr. Dabell as Conservative members. Alderman Fraser then nominated the Mayor and Messrs. E. L. Manning and S. Cook. Dr. Brown Sim inquired whether the gentlemen named had consented to serve; and though at the moment no reply was made to the question, it subsequently led to some discussion, after which Dr. Brown Sim moved that Dr. Dabell be not appointed till he had given his consent. Mr. Sands seconded this, but it was lost; Alderman Fraser remarking that it was absolutely unprecedented for two of his Liberal friends to object to the appointment of gentlemen nominated by Sir John M'Craith. Alderman Pyott moved another amendment (which shared the same fate), that the appointment of the Committee be deferred for a month—giving as his reasons that it was not required at all, and that it would be almost impossible for it to carry out the duties. The members nominated were then duly appointed.

During the meeting, Sir John Turney said he regretted that he was not present when it was decided in January that another unfortunate Committee should be appointed to take into consideration the affairs of the gas undertaking. He could not for the life of him understand why this thing was not settled long ago. He did think, with all due respect to his friends, that it was a waste of time and a stupid thing to proceed with it. The people in the city did not want to know who had made the blunder in the past, because it would not help those who had control to manage the undertaking on business-like lines. Did they suppose, he asked, that the men who gave evidence before—he would call it—the Select Committee, would give evidence again?

PUBLIC LIGHTING IN THE CITY OF LONDON.

Extended Use of Incandescent Gas.

Since the commencement of the year some changes have been made in the public lighting arrangements in the City of London. The two arc columns by the Mansion House and Lombard Street have been removed, and their place taken by a high-power gas-lamp similar to those in Queen Victoria Street and an ordinary incandescent gas-lamp. The arc lamp on the approach to London Bridge, deemed to be no longer necessary owing to the light from the high-power gas-lamps on the bridge, has also been removed. With the exception of the small piece of arc lighting in King William Street, this completes the ring of high-pressure gas lighting commencing at the Southwark end of Blackfriars Bridge, and traversing Blackfriars Bridge Approach, Queen Victoria Street, Mansion House Street, and Lombard Street, to the Bermondsey end of London Bridge—constituting one of the most magnificent demonstrations of high-pressure gas lighting in the United Kingdom.

In addition to completing the area named, it should be mentioned that the Tower Bridge and Southwark Bridge are similarly lighted by the South Metropolitan and Commercial Gas Companies; while in other areas and at various points and wide crossings in various parts of the City high-pressure lamps are in use, either connected directly with the mains or worked by compressing plants. At the last meeting of the Court of Common Council, instructions were given for constructing a resting-place in the roadway of Fleet Street, by Chancery Lane, with an incandescent gas-lamp thereon; and a recommendation was passed that the City of London Electric Lighting Company be called upon to remove the electric lamp in Fore Street, by Cripplegate Churchyard, and that two double-burner incandescent gas-lamps should be fixed on the adjacent premises.

THE LIGHTING OF OXFORD STREET.

In the "Electrical Review" for the 25th ult., a statement was made that the cost of 81 flame arc lamps now used for lighting Oxford Street, at £20 13s. 7d. per lamp per annum, worked out at "a total for the whole lighting exactly equal to that of the previous inferior gas lighting."

Mr. F. W. Goodenough, the Chief Inspector of the Gaslight and Coke Company, deals with the statement, in a letter to the "Review," in the following manner: "As I am confident that you desire only to give your readers accurate information, I should like to correct this statement. The charge for the 81 arc lamps amounts to £1675 per annum. The cost of the previous gas lighting was one-third of this amount—approximately £550 per annum. The estimated annual cost of lighting Oxford Street by modern gas-lamps, according to the scheme submitted by my Company, and pronounced by the Council's Lighting Committee (after prolonged and careful inquiry) to be preferable to the electric lighting scheme since adopted, was £1680. The Electricity

Committee fixed their present rate of charge after this Company's quotation had been made public. Their original estimate was £110 higher. The estimate for gas provided for all lamps alight all night. Nearly one-half of the arc lamps are extinguished at 12.30 a.m. A similar arrangement with gas would have reduced the cost nearly £200 per annum. The installation cost of the arc lamps was estimated at over £3400, with an additional £3000 for mains. The inclusive estimate for gas was well under £2000. The decision to adopt electric lighting was arrived at by the Borough Council—in the face of the recommendation of its Lighting Committee in favour of gas as being more economical and more efficient—solely on the question of 'loyalty' to their own undertaking. The borough is, consequently, sacrificing some hundreds a year in order to make a profit (?) on the sale of about £900 worth of current. It is as well that these facts should be put on record for your readers, lest the statements made in your 'Notes,' under a misapprehension, should lead them into misleading others and coming to grief on being faced with the truth."

The Editors of the "Electrical Review," in a note to this letter, say: "The note in question was received from an official source, but obviously the word 'previous' should have been 'proposed.' We understand that the ordinary rates of charge are in force for this service, and taking into account its excellent character and the necessity for good lighting, the installation cost appears to be justified."

GAS v. ELECTRICITY IN POPLAR.

At the Meeting of the Poplar Borough Council last Thursday evening, Alderman P. A. White moved: "That the Town Clerk do forthwith invite the Commercial Gas Company to state fully the conditions and terms upon which they would, if required, undertake to illuminate by gas, with an efficiency equalling, and wherever reasonably possible or necessary exceeding, that obtaining in the roads and streets now lighted by electricity; that such statement do refer, definitely and separately, to the supersession of the existing arc and incandescent (electric) lamps respectively, also to the exclusion and inclusion of the cost of conversion; and that on receipt thereof the Finance Committee do proceed to advise the Council on the financial results which would accrue from an early reversion to the use of gas as the sole illuminant publicly provided for the roads and streets of the borough." Alderman White said there were two points to which he would draw attention—first, that the Council were responsible for the public lighting; and, secondly, that in the near future they would be asked to consider a proposal for a large expenditure in extending the electric light undertaking. The latter would require much investigation. The Council's duty was to save the ratepayers' money; and they should not consider his motion as likely to harm the electric undertaking, because if it was disclosed that gas was cheaper than the electric light, they had a duty to the ratepayers which was greater than that they owed to the electricity undertaking. The duty he referred to was to use the cheapest method of lighting available. The motion was a very moderate one, and did not commit the Council to anything but inquiry. Alderman Green, in seconding the proposition, pointed out that it was most desirable that the Council should be in possession of the information asked for. Mr. Barge, the Chairman of the Electricity Committee, appealed to the Council not to pass the motion. He said that even if they saved money in one way by using gas, they would lose it on the electricity undertaking. Were they to stultify themselves just when there was a probability of the London County Council buying the undertaking if their Bill passed Parliament? Mr. Stephens argued that the electricity undertaking should be considered, quite apart from the Council, as a business concern. It was well known that further capital would shortly be needed for it, and, as a matter of common sense, he suggested that before this was done they should find out if gas was cheaper and better than electricity. As to the suggestion of the Chairman of the Committee that, even if there was a saving on gas, the ratepayers would lose by the reduced consumption of current, he thought it would be generally admitted that if they sold less energy for light they could sell more for power if this branch of the business was pushed. After some further remarks, Alderman White, in reply, said the electricity undertaking had been an absolute and unqualified failure, so far as the supply of light to private houses, for which it had been established, was concerned. All they were doing now was supplying manufacturers with power at low rates, at the expense of the public and a few private consumers. On a division, the motion was lost by 25 votes to 16.

MAIDSTONE GAS COMPANY'S BILL.

The provisions of the Bill which the Maidstone Gas Company are promoting were explained at an extraordinary meeting of the shareholders last Thursday week, by the Chairman (Mr. George Marsham), who remarked that the Board had determined to secure an extension of the limits of supply. A year ago, the Directors had had interviews with the Chairmen of the Parish Councils of Harrietsham and Lenham, who desired the Company to extend their mains to those parishes. The matter had been carefully gone into; and it was found that it was likely to be a remunerative business, especially as Harrietsham and Lenham were well situated with regard to elevation, being 300 feet above the level of Maidstone, and compact villages. The Directors therefore gave an undertaking that they would go to Parliament this year, and obtain the requisite powers. This was necessary because another Company—the Mid-Kent Gas and Water Company—had approached the parishes, and were anxious to supply them, though they could not do so at such a moderate price as their own Company would—namely, 3s. 7d. per 1000 cubic feet, subject to the sliding-scale. The Directors also thought it well to include other parishes in regard to which at present they had no power—Broomfield, Chart, East Sutton, Sutton Valence, Ulcomb, Boughton Malherbe, and Hunton. Sutton Valence had already a Gas Company of its own, concerning which undertaking the Directors were hoping to come to terms for purchase. If they did not, they would strike out the parish of Sutton Valence. While they were going to Parliament, the Directors thought it well also to include a few other matters. In recent years, the strictness of the law as to some of the sulphur impurities had been relaxed; and the Board proposed to take advantage of this, and, without any inconvenience to the consumers, get relieved of certain penalties. There was also a clause as to special apparatus for testing illuminating power, which was in accordance with what the leading Metropolitan Companies had done; and there was a clause to provide for power to lay down pipes for ancillary purposes. Another clause would enable them to connect their works with the railway line. They were in hopes of obtaining the consent of the South Eastern and Chatham Railway Companies; and if so, a short tram-line would be constructed from their wharf to the railway. This would enable them to get their coal by rail, if it should ever be necessary, and to send away their coke or other residuals by the same means. The Directors hoped to get the Bill through Parliament without opposition; and they felt assured that the additional powers would enable them to increase their business on safe lines, and prove of considerable benefit to the Company.

EFFECT ON MEAT OF COOKING BY GAS.

In their issue dated the 2nd inst., the "Lancet" asked whether cooking by gas was injurious to the meat; and they then proceeded to answer this question to the following effect.

Cooking by gas, by the method which is nearest to that known as roasting in front of the coal-fire, is generally conducted so that the meat is exposed to the direct heat of the gas-flames, and the products of combustion sweep the surface of the joint. If the cooking were done by the gas-oven being heated on the outside, it is difficult to see why such a process should be different in any respect from that in which the cooking is done in the ordinary range-oven heated by a coal-fire. The question narrows down, therefore, to a consideration of the effects which the products of gas combustion—whether they be complete or incomplete—are likely to have upon the meat. We may thus count upon the exposure of the meat to small quantities of such incomplete products of combustion as carbon monoxide, acetylene, and sulphurous acid, and to the complete products carbon dioxide, steam, and traces of sulphuric acid. It is well known that during the cooking of meat by whatsoever process, the meat loses weight, or, in other words, there is a constant emission of vapour; and consequently it can hardly be supposed that absorption can be going on at the same time. But assuming that not to be the case, what effect is the bombardment of small quantities of carbon monoxide, acetylene, and sulphurous acid likely to have on meat, and would these effects render the meat less suitable for food? Both carbon monoxide and acetylene form molecular combinations with the colouring matter of the blood; but then at the high temperature of the cooking process, it is hardly conceivable that such a combination could take place, besides which a plentiful supply of air would prevent either carbon monoxide or acetylene from being permanently absorbed. The minute quantity of sulphurous acid would tend to bleach the colour of the meat; but as a rule no effect of this kind is observed. If sulphuric acid is formed, this at a high temperature might possibly char slightly the surface of the joint. All such speculations, however, are strongly discounted by the fact that meat during its cooking is emissive, and not absorptive. As to steam and carbonic acid, it is questionable whether they could have any depreciatory chemical action at all. The conclusion seems inevitable, therefore, that any differences that are shown between meat cooked in front of the fire or in an oven next to the fire and meat cooked in a chamber containing gas-flames inside, must be due entirely to physical, and not to chemical causes. In a word, the explanation must lie in the different manner in which the heat is applied in the different circumstances. It should be borne in mind, however, that in cooking by gas the meat is exposed to a rapid current of steam derived from the combustion of the gas; whereas in the range-oven the only steam present is that which comes from the meat itself; while in open roasting in front of the fire there is no atmosphere of steam round the joint at all, the air is free to play over its surface, and the cooking is done by radiated heat. We believe the process of open roasting is far superior to that of close roasting. The flavour of the meat so cooked is invariably better; and the tissue itself is generally more tender, when it is cooked by roasting, and, consequently, more digestible.

We are inclined to put forward the view that the cooking of meat by gas is less satisfactory than cooking by the open roast method, because in the former case the joint is cooked partly by ascending heat currents and partly by steam. According to this view, cooking by gas may be regarded as a hybrid process—that is to say, part boiling or steaming, and part roasting. The constant stream of steam over the surface of a joint of meat is calculated to extract some of its flavour, and to exert a toughening effect on the tissues of the meat. We do not think, however, that any difference between the effects of gas-cooking and cooking by roasting or in the range-oven can be regarded in a serious light from a point of view of dietetics. The differences, in our opinion, are due entirely to different physical conditions under which the meat is cooked; and we may, we think, safely exonerate the gas-cooker from any suspicion of poisoning the meat by reason of the escape of unconsumed gaseous products from the gas-flame. The process of grilling meat exposes that food to a torrent of incomplete products of combustion compared with what happens in the gas-cooker; and yet a grilled chop is very popular—"the taste of the grill" (the sulphurous acid, and perhaps a little smoke) being held in esteem; but the gases round the chop in this case do not contain anything like the proportion of hot aqueous vapour which is present in the gas-cooker.

Dorchester Gas-Fittings Company, Limited.—At the meeting of this Company to-day, the Directors will recommend a dividend of 6d. per 10s. share (7s. paid) for the year ending the 31st of December last, which will leave a balance of £155 to be carried forward.

SIR GEORGE LIVESEY AND GAS COAL PRICES.

[From the "Newcastle Daily Journal," Feb. 11.]

We have the following communication on this subject from a correspondent interested in the coal trade: "Sir George Livesey and others have been exercising their minds lately about the high prices they will have to pay for gas coals this year; and I note that the 'JOURNAL OF GAS LIGHTING' seems to be Sir George Livesey's echo in this matter. Sir George Livesey is a very able man, and has undoubtedly been the strongest power that the producers of gas coals have had to deal with in the gas industry. Many years ago, he made it his business to obtain parliamentary sanction to an arrangement by which he undertakes to supply London consumers with gas on a sliding-scale—ignoring altogether the fact that the cost of producing coals (which is the raw material for gas making) is going up year by year. Since that time he has always failed to recognize that there should be any increased prices paid to the coal producers in comparison with the increased cost of production. Now, what are the facts? For many years the London Gas Companies bought their coals below cost price; and it is only owing to the booms which take place from time to time that the coalowners have been able to get any interest upon their capital. Bearing this out, I am in a position to state that the average price paid by Sir George Livesey, during the last 21 years, to the gas coalowners in the North of England under his contracts (including both depressed and boom years) was 7s. 9d. per ton f.o.b. This represents at the pit 6s. 3d. per ton, and delivered in London c.i.f. 11s. per ton. Can any reasonable person say that this is an exaggerated price? Sir George is apparently quite content to go on at low figures when prices are unremunerative to the coalowners in order that his shareholders may profit; but he soon raises a hullabaloo when prices are advancing, owing to the great demand for coals all over the world, which enables the coalowners to recover interest for depressed years, and to increase wages to compensate the workmen for low wages during depressed years. Doubtless Sir George is under the impression that all coalowners make large fortunes; but this, unfortunately, is the exception, as it is admitted by all experts who have examined the question that for the last 20, 50, or 100 years, without taking into consideration the capital lost by pits having to be closed, the return on coal investments has not exceeded 5 per cent. per annum. If Sir George thought it to the interest of his Gas Company, he would not have hesitated to have shown his usual enterprise by opening out a coalfield of his own. As to combination, there is no combination whatever among the coal producers in the Durham and Yorkshire districts at present; but is it not well known that Sir George Livesey has been always in close conference with various gas companies with the avowed object of keeping down the prices of coal?"

GAS IN LONDON IN THE EARLY FIFTIES.

As we have recently been calling attention to the centenary of the lighting of Pall Mall by gas, it may be permissible to refer to an incident in connection with the gas supply of the Metropolis which took place nearly fifty years later, and which was deemed of sufficient importance to be pictorially described at the time in the "Illustrated London News." A few of the more elderly of our readers may possibly remember the position of the various Gas Companies in London in 1848, who, with their total capital of about £3,500,000, and prices ranging from 6s. to 7s. per 1000 cubic feet, rested in fancied security from attack. This delightful feeling of tranquillity was disturbed by the appearance of a new-comer, who proposed to supply gas at a maximum price of 4s. per 1000 cubic feet. This Company—whose title was the "Great Central Gas Consumers' Company"—secured the services of Mr. Alexander Angus Cross, put up works on Bow Common, and, in the face of much opposition, began to supply gas. The new Company, of which Mr. Dakin, the tea merchant, was the Chairman, had from the first the countenance of the City; and on the 9th of July, 1853, the works were visited by the Lord Mayor and Sheriffs in state. Our illustrated contemporary gave in the next issue a view of the works, with the state coaches and the gold-lace coated footmen in the yard. The various processes connected with gas manufacture were explained by Mr. Croll (who was then one of the Sheriffs) to the visitors, among whom were the City Solicitor (Mr. Charles Pearson), several members of Parliament, and a considerable number of merchants and City men. After inspecting the works, the company went over Mr. Croll's alum manufactory, and in the evening dined at the Brunswick Tavern at Blackwall.

The event has a certain interest from the fact that the writer of the account of the visit gave some particulars in regard to the works. He said that their producing power was 800 million cubic feet per annum, and that they had cost £210,000, one-seventh of which had been spent in law. Works of such magnitude had never, he believed, been constructed for "less than three times the amount." The mains were nearly 70 miles in length; the four gasholders could store about 2 million cubic feet of gas, "produced by retorts placed in two rows of arches, the one over the other, each upper arch containing six clay retorts, and the under arch seven of iron, and each retort producing on an average 8000 cubic feet per day." The heating of the retorts was done by "fires only 7 inches wide by 28 inches long," which the writer was given to understand was "only about one-fourth of the size generally in use." What struck him as being an ingenious and wise expedient for "getting rid of one of the abominations generally connected with gas-works was the use made of the offensive coal tar. Instead of being permitted to accumulate and pollute the air, it was carefully stored in tanks, and introduced into the fire as fuel to heat the retorts." Each section of these, we are told, occupied a space 8 ft. by 19 ft., and carbonized from 10 to 11 tons of coals, producing about 100,000 cubic feet of gas, per day. The writer was greatly struck with the "massiveness and simplicity of the works." The Company, as may be remembered, was amalgamated with the Gaslight and Coke Company in 1870.

On another occasion, according to the publication already alluded to, the Lord Mayor formally opened the new gas-meter factory of Messrs. Croll, Rait, and Co., in the Kingsland Road. After inspecting the building, his Lordship visited the lower fitting-room, which was handsomely decorated for the occasion, and in which dinner was served at tables extending the whole length of the spacious apartment on both sides, with a cross table at the head. Here his Lordship addressed the assembled workmen and their wives in a speech of considerable length, detailing the origin, progress, present position, and prospects of the manufacture of gas.

THE DEEP BORING FOR WATER AT LINCOLN.

Report by the Engineer.

In the last number of the "JOURNAL" (p. 364), it was stated that the Water Committee of the Lincoln Corporation had decided, after an interview with Mr. Percy Griffith, M.Inst.C.E., the Engineer under whose advice the above-named work has been carried out, to continue the boring an additional 180 feet into the sandstone, and thereby complete the scheme originally contracted for. The statement made to the Committee verbally has been put by Mr. Griffith into the form of a report addressed to the Mayor and Corporation; and it came before the Council last week.

It will doubtless be remembered that when the boring reached the water the latter was found to be unsuitable for a public supply; and the problem awaiting solution was as to whether or not the undertaking should be abandoned. Mr. Griffith points out that this depends upon the evidence available with regard to the prospects of failure or success respectively. But he considers it would hardly be denied that to abandon a scheme upon which upwards of £20,000 has been spent, and more than five years of time occupied, while there is any reasonable prospect of success, would be regrettable in the extreme. He thinks the facts and opinions he can bring forward will show clearly that unless the boring is continued to a total depth of 2200 feet, it cannot be claimed that the Committee have done everything possible to render the scheme successful.

With these introductory remarks, Mr. Griffith proceeds to deal with the geological aspect of the problem. He points out that the main factor governing the question of boring deeper is, of course, the nature of the strata immediately below the level now reached—viz., 2015 feet from the surface; and in order to consider this matter clearly, it is necessary to decide upon some datum which is common to other borings of which records are available and also to that at Boultham. Fortunately, there is no difficulty in deciding on such a datum; the base of the Keuper marl having been indisputably proved at 1561 feet below the surface at Lincoln. At the date of his report of 1899, only two sections of the strata in the Lincoln area were available—viz., those at Scarle (or Collingham) and at Gainsborough. Since then borings have been carried out at Haxey (South Carr) and Scunthorpe; and as the base of the marl is clearly shown in each case, Mr. Griffith appends the following tabular statement, giving the thicknesses of the sandstone and its principal subdivisions for purposes of comparison.

—	Gainsborough.	Scarle.	Haxey.	Scunthorpe.
	Feet.	Feet.	Feet.	Feet.
Sandstone ? Keuper	315	205	609	667
Pebble beds	400	319	437	197
Soft sandstone	75	223		not proved
Total	790	747	1046	864

In the cases of Gainsborough and Scunthorpe, there is considerable doubt as to whether the borings actually reached the base of the sandstone; but the evidence is ample to prove that a total of at least 750 feet of sandstone may be expected at Lincoln; and as the boring has reached a depth of 454 feet in the sandstone, Mr. Griffith thinks it is clear that a further depth of at least 300 feet may be confidently expected. In this opinion he is supported by an eminent geologist.

On the subject of analytical data, Mr. Griffith says that the figures quoted in a postscript to his report of Dec. 13 last, show a remarkable similarity between the water first obtained at Gainsborough and the present supply at the Boultham boring. Since that report was written, he has found that the proportion of combined chlorine was much less at Gainsborough than it is at Lincoln; the figures being 2·4 grains per gallon in the former case and 34·33 grains in the latter. However, he gives another tabular statement showing the relative results obtained at Gainsborough and Lincoln (from first and from subsequent samples respectively) and at Scunthorpe; and he suggests that it indicates a probability that the lower portion of the sandstone at Lincoln will yield an improved quality of water, as was the case at Gainsborough. He thinks the fact that the outcrop of the sandstone west of the city is considerably higher and of larger area than it is west of Gainsborough, readily explains the circumstance that the flow of water is so much greater in the former case. At Gainsborough, no water was met with until the sandstone had been penetrated 20 feet; and no considerable supply was obtained until a further 255 feet of boring had been carried out. The water-level at Gainsborough never rose higher than 15 to 20 feet below the surface; whereas at Boultham, he estimates that if the well lining were continued sufficiently high, the water would rise to a height of 60 or 70 feet above the surface. He is therefore very confident that, having obtained so large a flow of water from the hard sandstone rock, almost devoid of pebbles, already penetrated, a much larger flow will be obtained when the thicker beds of pebbles are tapped; and, the main channel for the water being through the pebble beds, he suggests that by tapping them a supply of water will be obtained which has not been in contact with the marls or is affected by the mineral salts dissolved therefrom.

Having stated facts and theories bearing upon the initial question, Mr. Griffith claims to have shown that the abandonment of the boring under present circumstances would not be justified; but he recognizes

that it is further necessary to show that no greater expenditure of time or money is involved by the alternative of resuming the boring. The initial step is to penetrate the sandstone to a further depth not exceeding 185 feet—this representing the depth included in Messrs. Chapman's contract. This will involve an outlay of £1250 if the original diameter of 12 inches is adhered to, or of £1550 if the diameter is enlarged to 24 inches, in accordance with the decision of the Committee. As, however, it is particularly desirable that further work of a purely experimental character should now be restricted within definite limits, he is prepared to advise that, should no improved results as to quantity or quality be obtained when the boring reaches a depth of 2200 feet, the scheme should be finally abandoned, so that an alternative one may be undertaken forthwith.

Mr. Griffith next deals with three possible contingencies which may arise as the boring proceeds. First, should the surface flow of water materially increase, but no improvement take place in the quality of the water, he recommends a further spell of pumping—say, not to exceed one month—which he estimates would involve an expenditure of £750. If no improvement resulted from this, he would then advise the abandonment of the scheme. Secondly, should the quality improve but the surface flow show no increase, the Committee will be in the position of having an available supply of at least 600,000 gallons per day pumping at a depth of 200 feet (as already proved); and he estimates that by pumping from a depth of 300 feet this would be increased to not less than 1 million gallons per day, and at 400 feet a probable yield of from 1¼ to 1¾ million gallons. As in this case a question may be raised as to the cost of pumping from such a great depth, he gives some figures on the subject. From actual tests at Gainsborough, the cost of fuel when raising the water 270 feet to the surface and 100 feet above it (in all 370 feet) was proved to be at the rate of 2⅛d. per 1000 gallons; and with a head of 400 feet to the surface and 200 feet above (total 600 feet), he estimates the cost of fuel at the rate of 3d. per 1000 gallons. Thirdly, if any considerable increase of the supply is obtained, and the quality of samples is appreciably better than that of the present supply (either before or after the month's pumping previously recommended), he thinks it would be well worth while inserting steel tubes in order to shut out the present supply from the upper sandstone; and he suggests that if, in the course of the further boring, a band of marl is met with, the diameter should be reduced in order to provide a ledge on which to bed the tubes. The cost of 500 feet of tubes would be about £1500; but he is very confident that an increased flow of water from the lower sandstone would itself shut out the water from the upper beds, and so render tubing quite unnecessary.

As it has been suggested that the boring, even if successful in other respects, could never yield sufficient water to provide a complete supply for Lincoln, Mr. Griffith, in conclusion, deems it desirable to deal with this point as clearly as possible. In the first place, the scheme has from the first been undertaken with a prospect of a maximum yield of 1 million gallons per day; and as more than this quantity is now available, it would hardly be reasonable to abandon the outlay already involved, if the quality of the water should ultimately prove satisfactory, even without any increase in the yield. He personally anticipates a considerable increase in the yield, and will be much surprised and disappointed if it is not possible to obtain at least 2 million gallons per day from a depth not exceeding 300 feet. This would more than equal the present maximum day's demand; and with the new service reservoirs now decided upon, and occasional assistance from the gravel pits and Hartsholme Lake, the available supply would serve for several years to come without having any recourse to the Witham supply. A second scheme would be necessary, under any circumstances, within a period of from five to ten years; as, though he agrees that it might be possible to obtain 3 million gallons of water per day from one particular site in the Lincolnshire limestone, this would involve such an expenditure in constructing deep-level adits, and would also drain such a large area around the works, that, for many reasons, he believes it would be preferable to duplicate the pumping-stations.

Further Boring Operations Sanctioned.

At the Meeting of the Lincoln City Council last Tuesday—the Mayor (Col. J. S. Ruston) in the chair—the Water Committee reported in their minutes that they had resolved that the Engineer be instructed to resume the boring at Boultham until the further order of the Committee, but in any event to a depth not exceeding 2200 feet; and that specimens of the cores be submitted to Professor Hull from time to time for examination. Mr. Newsum moved the adoption of the minutes, and said the appliances for deepening the bore were then being got ready, and the work would commence next day. Mr. Livens suggested that, in carrying out the work of deepening the bore, the Council should fix a limited sum to be expended, in accordance with the estimate of the Engineer. He felt that, considering the very great amount the bore had already cost, they would do well not to throw good money away over what he thought would prove to be bad. They had already exceeded the estimate by 50 per cent.; and therefore he would move that the further expenditure to be incurred should not exceed £1250. Mr. Kilmister was of opinion that the Corporation should not spend another penny on the work; and he proposed that the deepening of the bore be not proceeded with. Mr. White did not agree with this. He thought they should go deeper if there was any chance of getting water. Mr. Newsum said it was proposed to go 185 feet farther down; and the Committee had passed a resolution in such terms that they could stop the work after £500 had been spent, if there was no hope of reaching suitable water. Mr. Foster thought if they had been advised to go to a depth of 2200 feet, the Committee should go to that depth, even if it cost more than the estimate. What was the good of going to within 50 feet or so of the estimate, and then giving up the work? The experts would then say they should have gone to the depth estimated. In the end, the minutes were confirmed with the exception of the recommendation as to the boring; it being decided that the sum of £1250, apart from the reinstatement of the plant, should not be exceeded. It is to be hoped that some definite conclusion will now be arrived at.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

In an article in the "Dundee Advertiser" of yesterday, it was stated: "In Dundee last night complaint was general of the failure of the gas supply. In many instances, particularly in the suburbs, the diminution in the supply was so great that no light could be got for a time; and practically in every building where the illuminant is used the light was reduced to a mere flicker. Shopkeepers all over the city experienced difficulty in conducting business, and had to enlist the aid of the humble penny candle. In private houses it was quite impossible to read a newspaper unless it was held close to the burner. This state of affairs lasted for about an hour. When Mr. Yuill's attention was called to the matter, he immediately proceeded to the gas-works, and had the defect remedied. But naturally it was some time until the normal conditions of lighting were re-established. Mr. Yuill informed a reporter last night that the trouble began in the region of the works, and permeated to the suburbs. As to the cause, he was not prepared to dogmatize until he had conducted a further investigation into the matter. At the monthly meeting of the Town Council last night, reference was made to the failure. Mr. Ferguson asked the Convener of the Gas Committee as to the gas that evening. . . . Mr. Stevenson said he only heard of the matter when he came to the meeting, because he saw no appearance of it in the district in which he lived. . . . It would be thoroughly investigated, and the Committee would be informed of the facts at an early meeting." To-day, in the same newspaper, it is stated: "In connection with the breakdown of the gas supply in Dundee on Thursday evening, a preliminary and searching investigation has been made into the whole circumstances. Ex-Bailie Stevenson, the Convener of the Gas Committee, along with Treasurer Urquhart, visited the works yesterday afternoon, and interviewed the Manager, Assistant-Manager, and other officials. It transpired that the cause of the trouble was the lowering of the illuminating power of the gas coming from the retorts, as indicated on the photometer, caused either by too much air being pumped into the gas, or too much of the dregs from the retorts being drawn in. Temporary arrangements were made for preventing a recurrence of the trouble; and it was deemed advisable to call a meeting of the Gas Committee to deal with the matter. This meeting will, it is expected, be held on Monday afternoon, when a report will be submitted by the Manager."

In the Dundee Town Council on Thursday, the subject of the lighting of the thoroughfare of Overgate was introduced by a petition from shopkeepers and others, asking that the street be lighted by electricity. The petitioners considered that if, as was reported to them, gas was to continue to be the illuminant, they would require to take steps to have their just demands. Mr. Don, in support of the petition, said he supposed they were all at one in the opinion that if there was any street in the town that should be well lighted it was the Overgate. He contended that, before the Gas Committee came to the decision to light the Overgate with intensified incandescent gas-lamps, at a first outlay of £70, and an annual cost of £106, they should have consulted the Electricity Committee. He moved that the subject be recommitted, to allow a conference thereon to be held between the Gas and Electricity Committees. This proposal, after discussion, was agreed to.

We know now, through the proceedings which took place before Lord Salvesen in the Court of Session on Wednesday, and reported in another column, that the dispute which has arisen between the Edinburgh and Leith Gas Commissioners and the Kinneil Cannel and Coking Coal Company, Limited, has been brought about by the non-delivery of coal under a contract. The decision of the case will depend upon the Judge's interpretation of the documents which constituted the contract, with the custom of the trade to clear up doubtful points.

The Scottish Juniors got through a lot of business in Glasgow to-night. The paper by Mr. R. A. Campbell, upon "The Laying-Out of Gas-Works," gains in value when it is realized that it is practically a description of how the gas-works at Provan were laid out; Mr. Campbell having been engaged upon that work during the whole period of their construction and being still on the staff in the works. The inception of very large works may be an abstract intellectual operation. Their detailed location and physical construction require more severe application; the governing considerations being more numerous and much more exacting than the process of drawing to scale. When we have had two years' operation of the Provan works, and know how well they have fulfilled the intention of their designer and the expectations of the Gas Department, a narrative of the method in which their laying-out was approached must be of more value than if the works were not of dimensions so commanding, nor so conspicuously successful. Mr. Campbell rather held himself in, in the treatment of his subject; but in doing this he was able to give a short, simple, and enjoyable paper. Mr. P. M'Dougall's paper on the "Carbonization of Coal for the Manufacture of Coal Gas" was upon a subject which is of prime importance in the operation of gas-works after they are laid out and erected. It is a subject which possesses many phases, from the simpler and older forms to the more modern and complex. Mr. M'Dougall treated of the latter. Few possess the knowledge of the higher branches of the subject which Mr. M'Dougall has; and few have had the opportunities of acquiring that knowledge which he has had, under Mr. W. Blair, of Helensburgh, who is a leading authority upon gaseous firing. It is Mr. M'Dougall's disappointment that the subject is not better understood and more studied; and in his paper he strove to give a lead to those who desire to make themselves better acquainted with the invisible causes and effects that are to be met with in the higher branches of retort-house working. Both papers were well received, and led to a long discussion, the outstanding feature of which was that the views put forward seemed to appeal more to the seniors; from which the inference may be drawn that the papers were pitched in a key higher than the Juniors can tune up to.

Last Sunday evening, shortly before eleven o'clock, an explosion took place in the subway carrying the electric cable in St. Nicholas Street, Aberdeen. Three manhole covers were blown off, and from one of the manholes a large volume of flame rose into the air. No one was injured. Immediately before the explosion occurred, the electric

light in the centre of the city suddenly went down. After the explosion it was discovered that an electric light wire had fused and ignited an accumulation of gas in the subway.

At the monthly meeting of the Dunfermline District Committee on Tuesday last, it was explained that the work of putting in the puddle trench of the reservoir at Glenquay, from which a wide district, including the new Naval base at Rosyth, is to be supplied, was going on. They had excavated to 160 feet. The Contractors—Messrs. J. Young, Limited—had submitted rates which, in their opinion, were necessary for the completion of the puddle trench. It was agreed to have a conference on the subject with the Contractors, Sir Wm. R. Copland, M.Inst.C.E., the representatives of the Admiralty and the Inverkeithing Town Council, in order, if possible, to arrange for the completion of the trench on satisfactory terms. The Water Committee have recommended that Sir Wm. Copland be paid £1500 as his commission under the contract. To meet this, and the additional outlay in connection with the extra depth of the trench, it was resolved to apply for power to borrow a further sum of £60,000.

CURRENT SALES OF GAS PRODUCTS.

Week ending Feb. 9.

The demand for tar products in the London market has been good. The price of pitch has rallied, and is distinctly firmer. It is reported that 27s. 6d. has been bid for London pitch for next season; but makers are not at all disposed to sell just now, having already got rid of a large part of their production for the whole year. Crystal carbolic acid is perhaps hardly so firm, and 60° crude stands at from 1s. 8½d. to 1s. 9d. per gallon. Very important sales of ordinary London creosote have been made at from 2¼d. to 2½d. per gallon net at makers' works, according to position. The latest done in 90 per cent. benzol is 1s., usual terms. Solvent naphtha is very firm; and business has been done at 1s. 10½d. for the best quality. Sulphate of ammonia is quiet, but steady, and the demand is expected to be brisker within the next few days—the price on Beckton terms being £12 3s. 9d. to £12 5s. for this and next month.

LIVERPOOL, *Feb.* 9.

Sulphate of Ammonia.

The large makes, being for the most part sold in advance, continue to be taken against contracts; so that, although we are in the season of greatest production, available supplies have been in limited compass, and the market has again shown a hardening tendency notwithstanding unfavourable weather over the greater part of Europe. The closing quotations are £11 17s. 6d. per ton f.o.b. Hull, £12 to £12 1s. 3d. per ton f.o.b. Liverpool, and £12 2s. 6d. per ton f.o.b. Leith. Home buyers have been very quiet. In the forward position, buyers have not been much interested unless at something near prompt prices; but £12 5s. per ton is reported to have been paid for March-April delivery.

Nitrate of Soda.

This article is very quiet at 11s. 3d. to 11s. 9d. per cwt., according to quality, for prompt delivery.

LONDON, *Feb.* 9.

Tar Products.

There has been little alteration in the market for tar products during the past week. Pitch is firm, but with prices unchanged. Business has been done on the east coast at 25s. to June; and on the west coast, manufacturers have offered to sell at 24s. without success. In Manchester, business has been done at 23s. 9d., and in Liverpool at 24s. 6d.; but in each case for delivery some little time forward. In South Wales, makers of fuel appear to be well bought, and will only entertain business either to September or to the end of the year, and report having purchased for the former period at well under 30s. On the Continent, business is practically impossible for delivery this side of June; while for August-December, it is only possible to obtain prompt prices, and these figures dealers will not entertain at present. Creosote is firm. Some quantity of outside makes could be secured in London at 2d. per gallon; but the first-class London qualities could not be purchased direct at anything under 2½d. to 2¾d., while in some cases even higher figures are asked. Some quantity of oil was sold in the North at 2d. for delivery over the next six months; but in the Midlands very little is obtainable, and nothing under 2⅞d. would be considered. Solvent naphtha is steady, though it would doubtless be possible to buy upon the east coast at 1s. 1½d. In London, nothing could be secured at much under 1s. 4d.; while for very fine 95 per cent. quality, over 1s. 6d. is said to have been paid. Benzol, 90 per cent., is quiet. Business is reported in the Midlands at 8⅝d., naked, at manufacturers' works; but against this, business has been done at 10½d. f.o.b., casks included, on the east coast. In London, some quantity could be secured at 11⅜d., though generally makers ask 1s., at which price they sell small amounts from time to time. Fifty-ninety per cent. is steady, and also scarce; and what little quantity offers, commands the full market price. Toluol is firm, but there is little offering; while pure is very scarce indeed. There is no alteration in carbolic acid, and prices remain the same, though one or two prompt parcels have been purchased at good figures by dealers who made sales some time ago and are now short. In crystals, the market remains unchanged, and there is little business doing in same. There is no change in anthracene.

The average values during the week were: Tar, 13s. 6d. to 17s. 6d. Pitch, London, 25s. 6d.; east coast, 25s. to 25s. 6d.; west coast, 23s. 9d. to 24s. 6d. Benzol, 90 per cent., 10½d. to 11½d.; 50-90 per cent., 11d. to 11½d. Toluol, 1s. 1½d. to 1s. 2½d. Crude naphtha, 4¾d. to 5d.; solvent naphtha, 1s. 1½d. to 1s. 4d.; heavy naphtha, 1s. 2½d. to 1s. 4½d. Creosote, London, 2d. to 2¼d.; North, 2d. to 2⅛d. Heavy oils, 2¼d. to 2⅝d. Carbolic acid, 60 per cent., 1s. 8½d. to 1s. 8¾d. Naphthalene, £6 to £9 10s.; salts, 35s. to 40s. Anthracene, "A" quality, 1½d. to 1⅝d.

Sulphate of Ammonia.

Markets have been fairly well maintained during the past week, and there is a fair inclination to buy for prompt delivery; but dealers at present are not disposed to pay the premium asked by makers for forward. The principal London Companies are well sold, and will not consider anything under £12 5s. for whatever quantity they may have to spare between now and June. Other makes have, however, been placed at considerably under this figure. In Hull, the market may be taken as about £12 for prompt and £12 2s. 6d. for February-June. In Liverpool, business has been done for prompt at £12 to £12 2s. 6d., according to quality. In Leith, dealers refuse to offer more than £12 2s. 6d., which price makers will not give any consideration to, as they are well sold.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 396.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
590,000	10	Oct. 12	10½	Alliance & Dublin 10 p.c.	21—22	..	4 15 5
245,112	10	,,	7⅞	Do. 7 p.c.	14⅛—15½	..	4 16 9
200,000	5	Nov. 14	7	Bombay, Ltd.	6¾—7¼	..	4 16 7
40,000	5	,,	7	Do. New, £4 paid	5—5⅛	..	5 1 10
50,000	10	Aug. 30	14	Bourne- mouth Gas and Water 10 p.c. / B 7 p.c. / Pref. 6 p.c.	28—29	..	4 16 7
51,810	10	,,	7		17—17½	..	4 0 0
53,200	10	,,	6		15—16	..	3 15 0
380,000	Stk.	Aug. 15	12½	Brentford Consolidated	262—267	..	4 13 8
300,000	,,	,,	9⅜	Do. New	200—205	..	4 12 8
50,000	,,	,,	5	Do. 5 p.c. Pref.	120—125	..	4 0 0
206,250	,,	Dec. 13	4	Do. 4 p.c. Deb.	101—104	..	3 16 11
220,000	Stk.	Sept. 27	11¼	Brighton & Hove Orig.	232—237	..	4 14 11
246,320	,,	,,	8¼	Do. A. Ord. Stk.	163—168	..	4 18 3
460,000	20	Sept. 27	10	British	42—43	..	4 13 0
104,000	Stk.	Aug. 15	6	Bromley, Ord. 5 p.c.	121—125	..	4 16 0
165,700	,,	,,	4⅜	Do. do. 3½ p.c.	91—94	..	4 15 9
500,000	10	Oct. 12	7	Buenos Ayres (New) Ltd.	11½—12	..	5 16 8
250,000	Stk.	Dec. 13	4	Do. 4 p.c. Deb.	94—96	..	4 3 4
150,000	20	July 12	8½	Cagliari, Ltd.	24—26	..	6 6 11
100,000	10	Sept. 27	10	Cape Town & Dis., Ltd.	14—15	..	6 13 4
100,000	10	Oct. 26	4½	Do. 4½ p.c Pref.	8½—9½	..	4 14 9
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	50—52	..	5 15 5
50,000	Stk.	Dec. 28	4½	Do. 4½ p.c. Deb. Stk.	56—98	..	4 11 10
157,150	Stk.	Aug. 15	5	Chester 5 p.c. Ord.	110—112	+1½	4 9 3
1,443,280	Stk.	Aug. 30	5⅛	Commercial 4 p.c Stk.	110—113	..	4 12 0
560,000	,,	,,	5	Do. 3½ p.c. do.	108—111	..	4 10 1
475,000	,,	Dec. 13	3	Do. 3 p.c. Deb. Stk.	83—85	..	3 10 7
800,000	Stk.	,,	6½	Continental Union, Ltd.	124—127	..	5 2 4
200,000	,,	,,	7	Do. 7 p.c. Pref.	138—143	..	4 17 11
432,070	Stk.	Aug.	5½	Derby Con. Stk.	122—124	..	4 8 9
55,000	,,	Jan.	4	Do. Deb. Stk.	105—107	..	3 14 9
486,090	10	Jan. 31	11	European, Ltd.	24—25*	..	4 8 0
354,060	10	,,	11	Do. £7 10s. paid	18—19*	+½	4 6 10
15,203,110	Stk.	Aug. 15	4⅛	Gas- light and Coke 4 p.c. Ord. / 3½ p.c. max. / 4 p.c. Con. Pref. / 3 p.c. Con. Deb.	96—98	−1	4 9 9
2,600,000	,,	,,	3½		50—92	..	3 16 1
3,799,735	,,	,,	4		107—110	..	3 12 9
4,193,975	,,	Dec. 13	3		84—86	..	3 9 9
258,740	Stk.	Sept. 13	5	Hastings & St. L. 3½ p.c.	98—103	..	4 17 1
82,500	,,	,,	6½	Do. do. 5 p.c.	118—121	..	5 7 5
70,000	10	Oct. 12	11	Hongkong & China, Ltd.	19½—20½	..	5 7 4
4,940,000	Stk.	Nov. 14	8	Imperial Continental	181—184	−1	4 7 0
473,600	Stk.	Aug. 15	3½	Do. 3½ p.c. Deb. Red.	95—97	..	3 12 2
183,242	Stk.	Aug. 30	6	Lea Bridge Ord. 5 p.c.	120—125	..	4 16 0
306,083	,,	Dec. 28	4	L'rpool Unit'd Deb. Stk.	108—110	..	3 12 9
561,000	Stk.	Aug. 30	10	Liverpool United A	226—228	..	4 7 9
718,100	,,	,,	7	Do. B	167½—169½	..	4 3 1
144,140	Stk.	Sept. 13	7⅝	Maidstone 5 p.c.	145—150	..	5 1 8
75,000	5	Nov. 29	5	Malta & Medn., Ltd.	4¼—4⅜	..	5 5 3
560,000	100	Oct. 1	5	Met. of 5 p.c. Deb.	101—103	..	4 17 1
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	101—103	..	4 7 5
541,920	20	Nov. 14	3½	Monte Video, Ltd.	11½—12½	..	5 12 0
1,775,892	Stk.	Aug. 15	4⅝	Newc'tle & G'tesh'd Con.	110—111	..	4 3 4
406,025	Stk.	Dec. 28	3½	Do. 3½ p.c. Deb.	96—97	..	3 12 2
15,000	10	Aug. 30	10	North Middlesex 10 p.c.	20—21	..	4 15 3
55,940	10	,,	7	Do. 7 p.c.	13½—14½	..	4 16 7
300,000	Stk.	Nov. 29	8	Oriental, Ltd.	150—155	..	5 3 3
60,000	5	Sept. 13	7	Ottoman, Ltd.	6—6¼	..	5 7 8
398,490	5	Oct. 26	7	Primitiva Ord.	7⅞—8¼	..	4 6 2
796,980	5	Jan. 31	5	Do. 5 p.c. Pref.	5⅜—5⅝*	..	4 13 0
488,900	100	Dec. 1	4	Do. 4 p.c. Deb.	94—96	..	4 3 4
851,070	10	Oct. 12	7	River Plate Ord.	12¼—12⅝	..	5 7 8
300,000	Stk.	Dec. 28	4	Do. 4 p.c. Deb.	95—97	..	4 2 6
250,000	10	Sept. 27	8	San Paulo, Ltd.	13—13⅛*	..	5 18 6
70,000	50	Jan. 2	5	Do. 5 p.c. Deb.	48—50	..	5 0 0
135,000	Stk.	Sept. 13	10	Sheffield A	248—250	..	4 0 0
209,984	,,	,,	10	Do. B	248—250	..	4 0 0
523,500	,,	,,	10	Do. C	248—250	..	4 0 0
70,000	10	Oct. 26	10	South African	15½—16½	..	6 1 3
6,350,000	Stk.	Aug. 15	5½	South Met., 4 p.c. Ord.	127—129	−1	4 5 3
1,895,445	,,	Jan. 16	3	Do. 3 p.c. Deb.	84—86	..	3 9 9
201,720	Stk	Sept. 13	8	South Shields Con. Stk.	158—160	..	5 0 0
575,000	Stk.	Aug. 15	5½	S'th Suburb'n Ord. 5 p.c.	123—126	..	4 7 4
60,000	,,	,,	5	Do. 5 p.c. Pref.	123—126	..	3 19 4
112,533	,,	Jan. 16	5	Do. 5 p.c. Deb. Stk.	125—130	..	3 16 11
502,310	Stk.	Nov. 14	5	Southampton Ord.	107—112	..	4 9 3
120,000	Stk.	Aug. 30	6½	Tottenham A 5 p.c.	127—130	..	5 0 0
388,020	,,	,,	5	and B 3½ p.c.	104—106	..	4 14 4
137,500	,,	Dec. 28	4	Edmonton 4 p.c. Deb.	101—103	..	3 17 8
182,380	10	,,	8	Tuscan, Ltd.	10½—11	..	7 5 6
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	102—104	..	4 16 2
193,742	Stk.	Sept. 13	5	Tynemouth 5 p.c. max.	106—108	..	4 12 7
30,000	Stk.	Aug. 15	8	Wands- A 5 p.c.	—	..	—
255,636	,,	,,	6½	worth B 3½ p.c.	140—145	..	4 9 8
75,000	,,	,,	5⅝	and C 3½ p.c.	113—115	..	4 17 6
79,416	,,	Dec. 28	3	Putney 3 p.c. Deb. Stk	79—82	..	3 13 2
779,875	,,	Aug. 15	5½	West Ham 5 p.c. Ord.	104—107	..	4 15 9
185,000	,,	,,	5	Do. 5 p.c. Pref.	122—125	+1	4 0 0
193,300	,,	Dec. 28	4	Do. 4 p.c. Deb. Stk.	102—105	..	3 16 2

Prices marked * are "Ex div."

COAL TRADE REPORTS.

Lancashire Coal Trade.

Everywhere throughout the country where coal pits exist trade is at its best. The advance in prices has not diminished, but seems to have increased, the demand. At any rate, whatever the cause, there is a general clamour for coal of all kinds, and apparently an equal difficulty in meeting it. The ordinary output has for some time past been unequal to meet current orders; and stocks have been depleted. The removal of the export duty on coal has led to an increase in the orders from abroad. Large quantities are being shipped at Hull for the Continent. If the present hunger for English coal is not soon assuaged somewhat, the natural result will be to again raise prices. Gas undertakings are feeling the strain, and paying more for gas coal and cannel. Quotations on the Manchester Coal Exchange are as follows: Best house coal 14s. 6d. to 15s. 6d., secondary 13s. 6d. to 14s. 3d., common 10s. to 12s. 6d., burgy 8s. 10d. to 9s. 6d., best slack 8s. to 9s., medium 7s. 6d., common 6s. 9d. to 7s., coal for bunkers and export at the Manchester Ship Canal 10s. 6d. to 11s. 6d. Furnace coke meets with a good demand at prices ranging from 17s. to 24s.

Northern Coal Trade.

There has been considerable interest felt in the results of the tenders for coal for Sweden; the outcome being a disappointment—due to the fact that so much coal was refused by the Swedish railways owing to the high prices that were asked. Whether later tenders will end in acceptance, is still to be seen. As to the steam coal trade, prices are firm, on the basis of about 14s. 6d. to 15s. per ton f.o.b., for best Northumbrian steams, and from 12s. 6d. to 13s. for seconds. Steam smalls are steady at about 7s. 9d.; and the collieries are generally very busy for this season of the year. In the gas coal trade, the deliveries are now full; but the pressure of the demand seems to be a little less. Durham gas coals are quoted from about 12s. to 12s. 9d. per ton f.o.b., according to quality; and for the very best kinds, it is said that 13s. has been paid. As to contracts, the tenders have been sent in for the coal for the Stockholm gas supply; and it seems to be expected that the bulk of them will be allotted to the usual collieries. The price is believed to be somewhere about 12s. 6d. per ton f.o.b., but much depends on the allowance for freight. Gas coal, however, seems to show a little more quietness, possibly with the passing of the heaviest home demand of the season. Coke is steady, and there is some variation in the quotations for gas coke; but from about 13s. 6d. to 14s. per ton f.o.b. may be looked on as current North Country prices.

Scotch Coal Trade.

Prices continue to advance, which is a sign of the existing activity in trade. The demand for export is very strong; and the quantity of coal which is being taken up by iron-works is also very large. The prices quoted are: Ell 12s. to 13s. 6d. per ton f.o.b. Glasgow, splint 12s. to 12s. 6d., and steam 11s. to 11s. 3d. The shipments for the week amounted to 259,257 tons—a decrease of 1949 tons upon the preceding week, but an increase of 9386 tons upon the same week of last year. For the year to date, the total shipments have been 1,055,910 tons—an increase of 26,448 tons upon the corresponding period of 1906.

A Proposed Gas-Coal Combination.

Alluding to the question of a gas coal combination, the "Sheffield Daily Telegraph" last Wednesday said: "The arrangements for the formation of a Gas Coal Combination, to which we referred some little time ago, are proceeding apace; but the latest reports regarding the movement are hardly so favourable. The Notts and Derbyshire collieries, it is stated, are desirous of working together, with Lancashire and Yorkshire to do the same. This division has possibly arisen owing to the difference in the 'sperm' values of the coals; but whatever may be the outcome of the present negotiations, there is no doubt that the folly of low prices for gas coal is being forcibly brought home to collieries this year, as in many cases the difference between the prices of gas coal and the present market price which could now be obtained for the same quality of coal for house-fuel purposes is about half."

A gentleman connected with the coal trade, on being questioned by a reporter of the "Standard" on the rise in the price of coal, remarked that as the gas companies' new contracts would have to be made somewhere about March, he thought it very likely that the result would be an increase in the price of gas. Sir George Livesey was thereupon approached on this point; but he told the "Standard" interviewer that he thought "it would be very unwise to say anything about it at the present time."

Under the heading of "The Coal Boom," the "Yorkshire Post" last Wednesday made the following remarks: "West Yorkshire, along with other coal-producing centres, continues to participate in the boom that set in a few months ago. The position of the gas coal branch is unusually strong for this time of the year. Shippers are unable to obtain all they want; inquiry after inquiry yesterday not being satisfactorily met. The Leeds Gas Committee are in the happy position of having contracted for all their requirements up to June; but the Chairman (Mr. George Ratcliffe) and some of his colleagues have been in the market buying four 'small' parcels, totalling altogether 12,000 tons. The prices given are understood to be very satisfactory from the ratepayers' point of view, having regard to the position of the market."

Cost of the Chester Water Case.—The Chester Board of Guardians having lost the legal action in which they were recently engaged with the Chester Water-Works Company (as recorded in the "JOURNAL," pp. 42, 229), are now being called upon to pay the penalty of defeat in the shape of law costs. At their last meeting, a letter was read from the Solicitors, asking for £1000 on account of out-of-pocket expenses, which included £747 for Counsels' fees, £101 for the shorthand notes, and £142 for witnesses. The Chairman (Mr. T. Butler) remarked that when they began the dispute it was said by a member of the Board that it would not cost the ratepayers much over £80. Experience had, however, shown that it had cost thousands. It was decided to forward the cheque asked for.

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Llandrindod Wells Gas Bill.

When the Llandrindod Wells Urban District Council met to decide what action they should take in respect of the Gas Bill to be promoted in the ensuing session, the Clerk reported that the promoters had agreed to practically all the protective clauses which the Council had asked for; but this was on the clear understanding that the Bill was not opposed. Several councillors said they had been informed that Mr. David Davies, M.P., had offered to sell the existing electric light works, with all rights and privileges, to the Council at cost price, *plus* interest not exceeding 6 per cent.; the option of purchase to stand open for five years. A letter was handed in confirming this offer, which, however, was stated to be contingent upon the Council lodging a petition against the Gas Bill. While agreeing that the offer was a generous one, the opinion was expressed by some of the members that, as the Gas Company had met nearly all the Council's wishes, it would be hardly straightforward to now lodge a petition against the Bill. As the result of a vote on the question, the Bill will not be opposed by the Council.

Surveyors' Evidence.

Mr. G. Humphreys-Davies has replied to the letter of Sir George Livesey in "The Times," on the above subject, to which reference was made last week. Sir George, it may be remembered, expressed his inability to understand the meaning of the phrases "the amount of a valuation depends upon the purpose for which it is made," and "the value of the same thing necessarily varies according to the basis upon, and the purpose for, which it is made." Mr. Humphreys-Davies says: "Sir George will find my meaning if he will ask himself what is the value of the South Metropolitan Gas-Works to his Company, what is the value at which they stand in the Company's balance-sheet, what would be the value he would put on them if the County Council wished to purchase them, what value he would put on them for the purpose of rating, what price he would ask if some public body wished to acquire (say) a strip of 5 acres through the centre of the works for the purpose of constructing a railway or public road, and to what extent the value of the monopoly given to his Company by Parliament affects the value of the land that they acquired under their Acts. The statement of fact which Sir George makes affords evidence of the injustice of the charge which has been made, because, although *ex parte*, it shows that the surveyor was so anxious to avoid litigation, with its attendant risk and expense, that he advised his clients to accept the sum which was offered. The statement is otherwise immaterial to the question. But I may suggest that there is nothing immoral in asking a larger price than one is willing to accept, or in offering less than is demanded; because that is the basis upon which the markets for all commodities are conducted, and upon which even Sir George acted. We do not know why £22,000 was asked for the land which was acquired for £15,500; but I think that now they have acquired that land, his Company and their surveyor would, and quite properly, take a very different view of its value if some other public body obtained powers to take it from them."

Expensive Street Lighting at York.

Presiding at the half-yearly meeting of the York United Gaslight Company, the Vice-Chairman, Mr. James Melrose, remarked that the report and balance-sheet showed steady progress in the business; and, after paying their maximum dividend, they were able to recommend an addition to the reserve fund of £500, and to carry forward £377. Referring to the further extension of the electric lighting of the streets of the city—which, he said, was still in progress, notwithstanding the fact that it had been shown conclusively that incandescent gas was by far the cheaper and more efficient light—he reminded the shareholders that during 1905, with the object of bringing the street lighting of the city up to date, the Company converted all the gas-lamps from flat-flame to incandescent. With a view of proving their contention that the Corporation were not justified in putting the ratepayers to the extra cost involved—and the Company were payers of rates to the amount of over £2700 a year—a most careful estimate had been made of the difference in cost between the electric lamps now fixed in the city, as shown by the Corporation Year-Book, and the Company's incandescent gas-lamps, with the result that the increase to the present time was between £600 and £700 a year. In fact, it was just double the cost of the displaced gas-lamps. This extra cost, they must bear in mind, referred only to about one-tenth of the public lighting of the city. So far as efficiency was concerned, it was admitted that the streets were not so well lighted by electric lamps as they could be by the Company's incandescent gas-lamps. They asserted that they could, at half the cost, light the city better than the Electricity Department; and, if the Corporation would give them a fair and equitable arrangement, they were prepared to meet them in that spirit. Provided the terms were reasonable in other respects, they could probably make concessions in the price of gas, or by lengthening the time of lighting, which would be to the benefit of the ratepayers.

Increased Water-Rates at Liverpool.—The estimates of the Liverpool Water Committee, which have been adopted by the Council, provide for a water-rate of 7½d. in the pound in the city and Bootle, and 10½d. for places beyond. Last year's charges were 6d. and 9d. respectively; but the figures now returned to are those that were in force four years ago. Whereas the receipts in 1903 amounted to £83,176; in 1905 they were only £54,291.

The Retort-House Litigation at Belfast.—It has been resolved to carry out, at a cost not exceeding £1000, a suggestion put forward by Mr. James Stelfox for the erection of a ventilating chimney shaft and wrought-iron connections in the new retort-house at Belfast which is at present affected by an injunction obtained by a firm of linen manufacturers, who brought an action for nuisance against the Corporation. The legal proceedings in connection with the injunction have involved an outlay of something like £3000; and as the building represents about £40,000 of property, the Committee are naturally anxious to make as full use of it as possible.

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Charge to Prepayment Consumers at Leeds.

A resolution has been defeated by the Leeds City Council, which had for its object a reduction in the charge made to prepayment gas consumers as from July next. The proposer (Mr. H. Watson) said his point was that, as the users of prepayment meters paid cash, it was unfair to charge them an extra price for their gas, and for them not to get any equivalent to the discount which was allowed to the ordinary consumers. The Chairman of the Gas Committee (Mr. G. Ratcliffe), however, declared that no man of business principles could support the resolution. Leeds, he said, made a less extra charge than any other place in the country; and if the price were reduced to the users of automatic meters, the Gas Department would be speedily loaded with meters from ordinary customers, who would want automatic meters in place of them. Mr. Wilson advised Mr. Watson to withdraw the proposition. He had, he remarked, heard the question debated for fifteen years. The fact was that none of the small accounts paid the Corporation; and that being so, there was really no case for a reduction of price. It was asking the ratepayers as a whole to give benefit to a section. Mr. Clarke, on the other hand, contended that when plant became antiquated or out of date, the charge should be one against the whole undertaking. The gas accounts showed that a reduction could be made to the small users; and he therefore supported the resolution.

Consumption of Water in Manchester.

According to statistics prepared by Mr. W. Blackstock, the Secretary of the Manchester Corporation Water Department, the daily consumption of water has increased from 35 million gallons in 1905 to about 38 million gallons at the present time. Much of this, it is pointed out, is due to the boom in trade; but beyond the legitimate call in that direction, and the increased demands from local authorities in the area of service, there is an unaccounted-for consumption. In January, 1906, what is called the public supply of water was actually less than in January, 1905, though in the month just concluded that section of the output was nearly ¾ million gallons more daily as compared with the first month of 1906. The increasing application of water-carriage for the sewage of the city is, of course, a constantly enlarging factor in the consumption; but it is thought that a great amount of waste is taking place. At any rate, the existing condition of affairs is viewed with some alarm by the Water Committee. Steps are, as is known, already being taken for the laying of the third pipe from Thirlmere; but if the present growth of consumption is maintained, the fourth and fifth pipes will very soon be needed, so as to bring the amount from that source up to the maximum of 50 million gallons a day, in addition to the 23 million gallons a day from Langdendale. In 1880, the daily consumption was under 18 million gallons, or less than half that of last year. In 1900, a daily average of 32 millions was reached; and for the next two years there was a falling off, succeeded by more than a recovery in 1903, a very slight increase the next year, and a jump to 35 million gallons in 1905.

Writing Down Halifax Gas Plant.

At last Wednesday's meeting of the Halifax Town Council, the Gas Committee recommended that the present book value of certain plant at the gas-works be reduced from £67,077 to £36,160, and that this sum be debited to revenue account at the rate of £3616 per annum. Alderman Smith, the Chairman of the Finance Committee, said the course proposed to be taken by the Gas Committee would mean an increase of 3½d. in the pound, when considered in conjunction with the decision of the Electricity Committee to take £3000 a year for three years out of the revenue. He wished the members of the Council to realize this, and not blame the Finance Committee when the time came for levying the rates. He moved that the matter be referred back; and Mr. Spencer seconded the amendment. Mr. J. Collinson, the Chairman of the Gas Committee, explained that his Committee were endeavouring to conduct the gas-works on the basis of sound finance. If trading concerns had always to wait for an opportune time to write down their plant, the opportunity might never come. The minutes of the Gas Committee were confirmed.

King's Norton and the Testing of Birmingham Gas.

When presenting to the Birmingham City Council the report of the Gas Committee with regard to the Bill of the King's Norton and Northfield Urban District Council, as noticed in the "JOURNAL" a fortnight ago (p. 294), Alderman Sir Hallewell Rogers moved that the City Council should petition Parliament against the measure—which, it may be remarked, is to authorize King's Norton to place within their district testing-stations and apparatus for testing the gas supplied by the City Council. He said that when Birmingham acquired the gas undertaking in 1875, they specified in the Bill that the gas should have an illuminating power of 14 candles at the works; but the petitioners against it urged that the test should be applied at places distant from the works. Parliament decided that the testing-place should be at the works, but that the standard should be 15-candle power. During 31 years, the Corporation had carried out this obligation; but for some unexplained reason, the King's Norton Council, in whose district less than 10 per cent. of the gas was consumed, desired to impose on the Corporation an obligation which did not touch them under the existing statute. They had practically received no complaints from consumers in the King's Norton district during the last five years. Mr. Titterton, in seconding the resolution (which was carried), said that, as a resident in the King's Norton district, he was satisfied with the quality of the gas supplied by Birmingham.

At last week's meeting of the Barrow Town Council, the Gas Committee recorded the purchase of land at Salthouse for a proposed new gasholder. Alderman Barrow, in opposition to the scheme, expressed himself in favour of telescoping the present holders, which he said should be done at half the cost, while improving the pressure all over the town. The proposal was referred back to the Committee.

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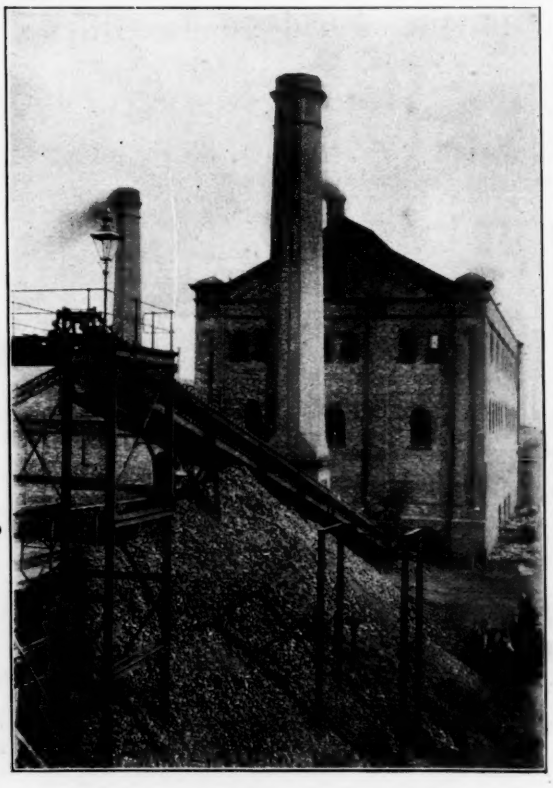

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At the meeting of the Company to-morrow week, the Directors will report a profit of £102,041 for the past year. Adding the balance brought forward, £17,537, there is for distribution a total of £119,578, which the Directors recommend to be appropriated as follows: Interest on debenture stocks, loans, &c., £18,999; intermediate dividends (less income-tax), £40,810; final dividends (at £4 and £4 12s. 6d. per cent. per annum, less income-tax), £41,570—leaving a balance of £18,198 to be carried forward. The quantity of gas sold during the past year was 2,960,424,000 cubic feet—an increase of 72,620,000 cubic feet, or 2·51 per cent., upon the sales in the previous year. The revenue from the sale of gas was £255,695, against £247,669; and from residuals £95,635, against £96,126. The coke market, which was weak in the first half of the year, gradually improved, and is at present in a strong position. The Company supply gas to 91,989 consumers—the number having been increased during the year by 9535 prepayment and 920 ordinary consumers. There are 53,015 cooking-stoves out on hire; being an increase of 9234 prepayment and 525 ordinary.

Wolstanton Gas Scheme.

A lengthy discussion took place at the last monthly meeting of the Wolstanton Urban District Council with reference to a resolution which had been agreed to at a special meeting held previously; but nothing was done to upset the decision already come to. At the special meeting—the business of which was taken in committee—the Clerk (Mr. E. Hollingshead) read a letter from Messrs. Corbet Woodall and Son, forwarding plans of the proposed new gas-works, prepared in accordance with the instructions of the Council. The plans were laid before the meeting, and explained by Mr. Woodall. Detailed information as to the cost and capacity of the works, and the cost of production and distribution of gas, were given; and figures were also produced by Mr. Woodall showing what the position would be if the Council purchased gas in bulk. The alternative proposals were considered at great length; and after the rejection of a resolution to the effect that tenders for the supply of gas in bulk for five years should be obtained from the British Gaslight Company and the Burslem and Newcastle Corporations, the following motion was declared carried: "That the plans for the erection of a new gas-works at Chesterton, prepared by Messrs. Corbet Woodall and Son, be approved and adopted, and Messrs. Woodall instructed to proceed with the specifications and obtain tenders for the necessary work, to be brought before the Council."

The Trouble with Inverted Gas-Globes.

In the current number of the "Ironmonger," there is the following letter on this subject by an engineer: "Some weeks ago you published numerous letters and an article relating to the failure of the globes belonging to inverted incandescent gas-burners, in which the blame for the breakage of the globes was largely ascribed to the burners themselves. The experience I have had during the last few weeks, however, tends to show that the blame may often attach itself to the glass, or to the makers thereof, rather than to the burners. About three years ago, I put up an inverted burner in my kitchen; selecting for it a particular globe which appealed to me because it was colourless and practically devoid of ornamentation. That particular globe has remained in regular service to the present day. At the beginning of this winter, I erected two inverted burners elsewhere, and, in consequence of my experience, chose for them globes of the same pattern, and, presumably, make. One of these globes lasted about fourteen evenings, the second about four, and the third about three; and they all broke with loud reports from the bottom upwards, showing that they had not been nipped. An inspection of the last two showed that the cracks gaped before the pieces fell apart; and therefore it was evident that the glass of these newer globes, unlike that of the first specimen, was originally in a state of strain, having presumably been insufficiently annealed. I may add that all the fractures occurred on the one burner—a Kern—the mantle of which was in perfect condition."

The Price of Gas in New York.

Our readers are aware that litigation is pending between the Consolidated Gas Company of New York and some of the consumers, on the question of the price to be charged for gas. The matter was referred to at the recent annual meeting of the Company, when the reports submitted by the Treasurer, covering the period ended the 31st of December last, showed that the sum of $1,994,417 had been deposited, pending the final decision of the Courts. It is explained that this deposit represents the difference between the amount collected by the Company at the $1 per 1000 cubic feet rate and what the sum would have been had the rate collected been 80 c., as provided for by the Act of the State Legislature. The deposits have been made under a ruling in the United States Circuit Court permitting the Company to charge the old rate upon paying into Court the price charged in excess of 80 c. As this order was effective from May 1 last, it is shown that during the eight months remaining in 1906 and covering the period during which the above-named deposit was made, the Company did a gross business in gas amounting to $9,972,085. This is at the rate of $14,958,120 per annum, which indicates that, providing the Company are eventually forced to furnish gas at the 80 c. rate, the annual loss, under the present consumption, would be $2,991,624, or 3·74 per cent. on the $80,000,000 capital stock. The claims of the Company against the city for $2,884,789 for gas lighting and $2,613,821 for electric lighting are based on the terms of certain contracts entered into by the Company and officials of former administrations, over which there have been disputes resulting in the Company taking the matter to the Courts, where it has not been disposed of. Providing the Company win their case against the city, the amount to be collected, totalling $5,498,610, will be equal to 6·87 per cent. on the capital stock.

There was recently on view at an agricultural show in Berlin what is believed to be the first self-contained portable gas-engine and suction gas-producer plant. The whole of the parts were on one frame, which could be fixed on foundations or mounted on four wheels for transit.

RADIATOR PICTURES, No. 16.

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Incandescent Gas Lighting at Canterbury.—The Canterbury City Council have accepted the offer of the Gas and Water Company to convert and maintain the existing gas-lamps on the incandescent system, free of expense to the Corporation, at the existing contract charge of £4 per lamp; the gas contract to be in force for three years. It is, however, understood that the Council have the power to discontinue at will the use of any of the existing lamps.

Newquay Council and the Water Bill.—It was decided by the Newquay Urban District Council last Tuesday to oppose the Bill which is being promoted by the Newquay and District Water Company. The Council had asked for certain concessions and modifications of the Bill, and two letters had been received in reply; but it was stated that in these the Company did not deal definitely with the Council's request. It is understood that if the Company are prepared to meet the Council, the opposition will not be continued.

Reduction in Price at Reading.—The Directors of the Reading Gas Company have decided to reduce the price of gas to ordinary consumers by 2d. per 1000 cubic feet as from Dec. 31 last, and to increase the quantity supplied to users of prepayment meters from 23 to 25 cubic feet for 1d. The change as regards the prepayment meters will be commenced during the current quarter. Within the past 3½ years, the price of gas has been reduced from 3s. to 2s. 7d. per 1000 cubic feet in the case of ordinary consumers (no meter-rent being charged); and the quantity given through prepayment meters has been increased from 21 to 25 cubic feet for 1d.

Management of Llandudno Gas-Works.—The Llandudno Urban District Council have held a special meeting to decide upon the terms of appointment of the Gas Manager who may be chosen to succeed Mr. Thomas Davies, whose resignation was noticed in the "JOURNAL" for Jan. 8. A resolution was passed unanimously accepting the draft terms and list of duties submitted by the Gas Committee. According to these, the salary will be £145 to commence with, rising to £175, and a house rent free. Hitherto the Manager has been under the control of the Engineer to the Council, and has had to do with the manufacture of gas only; but in future he is to be under the control of the Gas Committee, and, in addition to being entirely responsible for the manufacture of gas, is to have charge of the meters, cookers, &c.

Abergavenny Corporation's Dispute with their Gas Manager.—Last October it was reported in the "JOURNAL" that, as a result of Mr. Hubert Russell refusing to place his immediate resignation of the position of Manager of the Abergavenny Gas-Works in the hands of the Gas Committee, it was decided to pay him a month's salary and terminate his appointment forthwith. This Mr. Russell refused to accept; and he commenced an action (which was down for hearing at the Monmouth Assizes this month) against the Corporation to recover damages for wrongful dismissal. After lengthy negotiations, however, Mr. Russell's Solicitor has notified his client's willingness—in order to end the matter—to accept £27 12s. 6d. in full settlement of any claim made against the Corporation. This is, it is pointed out, practically what the Corporation offered originally—the amount of salary then due to Mr. Russell, and one month's salary as an act of grace.

New Joint-Stock Companies.—The Combined Incandescent Mantles Syndicate is the title of an undertaking formed with a capital of £33,000, in £1 shares (3000 preference), to acquire the benefit of an option for the purchase of inventions relating to the manufacture of incandescent gas-mantles, with certain patent rights and other property, conferred by an agreement made between J. P. H. Soper and C. V. Houssart. There will be no initial public issue. The Wellington Tube-Works, Limited, is the title of a Company formed with a capital of £20,000, in £1 shares, to acquire the works and premises at Great Bridge, Staffordshire, known as the Wellington Tube Works, with certain plant and machinery; to adopt an agreement with A. J. Ash; and to carry on the business of tube makers, ironmasters, manufacturers of galvanized and corrugated iron and steel, &c. There will be no initial public issue. The first Directors are Messrs. A. J. Ash (Permanent Director and Chairman), Kenneth Aird, and W. H. Turner.

The Hoddesdon Gas Company have placed an order with Messrs. Biggs, Wall, and Co., for one of their new pattern rectangular sulphate of ammonia stills and heater, capable of producing one ton of sulphate per day.

What is described as the most destructive explosion in the history of Woolwich took place yesterday morning in the Chemical Research Department of the Arsenal; but though it caused much damage to property, it was fortunately unattended by loss of life. One effect, however, was to throw one of the gasholders out of position, and allow the gas to escape.

The Montrose Gas Company have placed an order with Messrs. Robert Dempster and Sons, Limited, of Elland, for a retort-bench, on Waddell's patent shallow regenerator system, complete with foundations, retort mountings, and with Scott and Dempster's patent travelling platforms in lieu of the usual floor-plate covering. These platforms are used at Galashiels, East Dereham, Lockerbie, Portadown.

We have received from Messrs. D. Hulett and Co., Limited, their new catalogue of gas-lamps for street and shop lighting, incandescent arc lamps and burners, lamp-columns, brackets, force-pumps, service-cleaners, &c. The bulk of the catalogue is devoted to lamps; and the samples shown include the "Humphrey," the "Lucas," the "Sydney," and others, in endless variety. An index facilitates reference to the contents. The catalogue is stitched in an artistic cover.

A young man named Charles Scott, living at Leeds (who was wanted by the police on suspicion of robbery), committed suicide by placing in his mouth one end of a tube the other end of which was attached to a gas-bracket. He tied a muffler round his nostrils and mouth, and made a hole in it to allow the tube to pass through. The tube was secured by a piece of string tied round his neck. The Coroner remarked to the Jury that a more deliberate act of self-destruction had perhaps never come before them.

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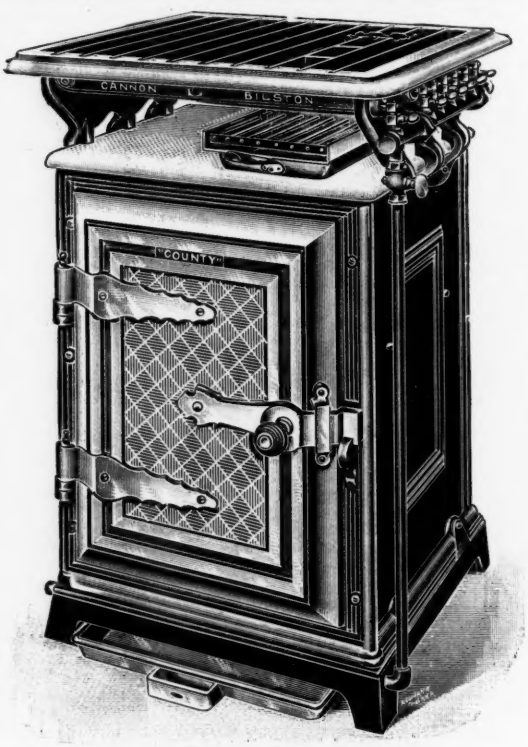

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